THE VALIDITY OF THE MODIFIED "STROOP COLOUR WORD TASK", IN THE ASSESSMENT OF ANXIOUS COGNITIONS, IN PANIC DISORDER SUFFERERS.

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Karen M. Knowles

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To: Karen Knowles

From: Ethical Review Committee

Re: A comparison between questionnaire measures of anxiety and the modified Stroop task: A direct measure of cognitive processing in panic disorder

The Ethical Review Committee gives approval for the study outlined in your research proposal, and wishes you well.

R.N. Hughes
Convenor

cc. Supervisor: N.M. Blampied

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The current study aimed to test the validity of a modified Stroop task in assessing cognitive processing patterns in panic disordered (PD) subjects, by comparing results of PD out-patients, before and after therapy (Experiment I), and with a members of a community course on panic (Experiment II). Stroop test results were also correlated with a variety of questionnaire measures. Subjects were administered a computerised version of the modified Stroop colour-naming test. Subjects named the colours of neutral, positive emotional and threat words associated with social threat, general threat, agoraphobic situations, somatic sensations and catastrophes. PD sufferers did not show an interference effect for specific threat word categories before treatment. Following treatment, the clinical group took longer to colour-name somatic words than to colour-name positive emotional words. The community group showed a similar pattern, taking longer to colour-name somatic words than positive emotional or neutral words. Contrary to expectations, the Stroop task did not differentiate between the clinical group, before and after treatment, or between the clinical and community groups. Partly these findings may be explained by methodological shortcomings in the current study. The modified Stroop test requires further investigation before it can be considered a valid assessment and evaluation tool for clinical practice. Specifically research is needed into the mechanism of the Stroop effect and standardisation of the words and method of administration.

CHAPTER I

LITERATURE REVIEW

Introduction

Historically cognitions have played some role in Psychological theories of anxiety, but, until recently, cognitions have not been a significant focus in the clinical psychology of anxious disorders (Brewin, 1988). Freudian theory recognised that traumatic memories may be repressed into the unconscious and that they need to be brought back into consciousness to be resolved (Brewin, 1988). In behavioural theories anxiety was seen as a fear response that had been conditioned by the environment (Brewin, 1988). Cognitive theories see mental processes as factors mediating behaviour, between stimulus and response (Brewin, 1988).

Recently cognitive psychology has its' base in experimental research, and focuses on the information processing of the individual (Brewin, 1988). Experimentation has illuminated the cognitive processes involved in emotional disorders, which has wide ranging utility (Mathews, 1988). Most importantly, this knowledge guides therapy for the disorders and should provide a method to quantify the effects of therapy. Various patterns of cognitive processing may predict vulnerability for certain psychological disorders and may also be an important factor in the recovery and coping process (Brewin, 1988).

If an individual has a psychological disorder then, it may reasonably be supposed, this will involve distorted cognitions. These distortions may come about from a biological or environmental origin. Cognitive biases involve selective processing of emotion relevant material, and tend to be emotion, content and task specific, not global deficits (Mineka and Sutton, 1992). The specific nature of these cognitive distortions is likely to differ between

disorders, giving the disorders their different characteristics. Depression appears to be related to a memory bias for self-referential material while anxiety appears to be related to an attentional bias favouring the processing of threat stimuli (Mineka and Sutton, 1992). A bias for threat stimuli may arise from a survival mechanism designed to protect an individual from further trauma. Within anxiety disorders, it appears that different threat material may be salient for different disorders. For example, spider referent material may be salient for spider phobia sufferers and internal somatic symptoms for panic disorder sufferers.

Schema

One current theory used to explain anxiety disorders is the cognitive/ behavioural model. The cognitive/behavioural model of anxiety places emphasis on the thinking processes of the individual (Bowers, 1986; Beck and Clark, 1988). The current study is based on the theoretical assumptions of Beck and Clark (1988). Beck and Clark (1988) divide cognition or thinking into three variables; cognitive structures, cognitive operations and cognitive products.

Schema are the human cognitive structures for encoding, storing and retrieving information (Williams and Nulty, 1986), and comprise long term memory (Brewin, 1988) formulae or rules (Hope, Rapee, Heimberg and Dombeck, 1990). Schema play an active role in selecting stimuli to be attended to and organising perceptual input (Brewin, 1988), according to rules based on experience (Hope et al., 1990). A cognitive set or schema is usually adaptive, helping a person reduce and quickly respond to information in their environment (Bowers, 1986). However, in anxiety disorders these cognitive sets might be biased, focusing on specific experiences or distorting them, not allowing other important information through to permit functional behaviour (Bowers, 1986). This may also play a part in maintaining the disorder, as, if a large amount of time is spend processing environmental

threats, this is likely to increase anxiety still further (Broadbent and Broadbent, 1988).

Cognitive operations are the way that information and the system interact. A maladaptive schema gives rise to systematic distortions in the processing of information. Some of these distortions that may play a part in cognitive disorders include *arbitrary inference, selective abstraction, overgeneralisation* and *personalisation* (Beck and Clark, 1988). There is a reciprocal relationship between cognitive structures and operations. The distortions strengthen the maladaptive schema which in turn make it more likely that the distortions will continue to operate (Beck and Clark, 1988).

Cognitive products are the output resulting from the cognitive processing. Cognitive products are generally outside our awareness, but, unlike cognitive structures and cognitive processes, with effort, cognitive products can be brought into awareness (Bowers, 1986). Cognitive products include voluntary cognitions and automatic thoughts or images comprising internal dialogue, which are instantaneous, transient and state-like experiences (Beck and Clark, 1988). Self report questionnaires tap into an individual's cognition at the level of conscious cognitive products.

Attention in anxiety

Bowers (1986, p47) defines anxiety as "the emotional and physiological response that accompanies fear". In anxiety disorders fear may occur even in the absence of fear stimuli. The cognitive theory of anxiety sees an individuals perception of an event that precipitates anxiety as being distorted by the individuals cognitive processing (Bowers, 1986). This leads to the threat generalising into other areas of life even though the initial event has passed (Bowers, 1986).

There is some evidence that anxiety states activate schemata involving physical or psychological threat. The fear or danger mode appears to be

overactive, not switching off when the threat is no longer present (Brewin, 1988). Anxious individuals constantly scan the environment for potential threat cues, resulting in early "perceptual pick up" of potentially threatening information (MacLeod, Mathews and Tata, 1986). Why this happens in certain individuals is not well understood. If anxious patients are hyper-vigilant, or sensitised, to stimuli perceived as threatening, then this is likely to limit the cognitive capacity left for other demands (Beck, Emery and Greenberg, 1985).

Panic attacks and Panic disorder

Panic is a component of most anxiety disorders. Panic attacks are more than just feelings of heightened anxiety, and include autonomic arousal (eg. heart rate increase, sweating, dizziness, shaking, nausea) and a change in mental functioning (depersonalisation or derealisation). As well as anxiety and somatic symptoms a third component of panic attacks is a fear of impending doom, most commonly fear of dying, having a heart attack, losing control or going crazy (Holt and Andrews, 1989). A fear of impending doom has been found to differentiate those with PD from those with generalised anxiety disorder (GAD), with the later instead attributing their symptoms to high levels of anxiety (Holt and Andrews, 1989).

PD consists of apparently spontaneous panic attacks and fear of having further attacks. Unlike simple phobias, where a feared object cues a panic attack, in PD the panic attacks appear to come "out of the blue". For a diagnosis of PD, four panic attacks must have been experienced within a four week period, or one panic attack followed by at least a month of fear of having another attack (American Psychiatric Association, 1987). Panic attacks can lead to agoraphobia, where an individual avoids certain situations because of fear of having a panic attack in public. Depression and alcohol or drug abuse commonly co-exist with panic disorder (American Psychiatric Association, 1987).

Age of onset of PD is typically in the late 20's (American Psychiatric Association, 1987). PD is a chronic condition with 50% of panicers still reporting impairment after 20 years and 85% remaining symptomatic (Michelson, Marchione, Greenwald, Glanz, Testa and Marchione, 1990). Prevalence is the percentage of the population who have met the criteria for a diagnosis over a period of time. A Christchurch, New Zealand epidemiological study found a six month prevalence for PD of 1.7% for females and 0.5% of males (Oakley -Brown, Joyce, Wells, Bushnell and Hornblow, 1985).

Studies, largely with students, have found that infrequent panic attacks are relatively common in the community. Norton, Harrison, Hauch and Rhodes, (1985) found that 35% of their sample of University students had experienced one or more panic attacks in the last year. Norton, Dorward and Cox, (1986) found that 22% of subjects reported one or more panic attacks in the three weeks prior to testing. This compares with an approximately 1% six monthly incidence of PD in the population (Norton et al., 1985). The infrequent panicers in Norton *et al.*, 's (1986) study produced higher Hopkins Symptom Checklist scores than non-panicers, with symptoms similar, but less severe, than those with panic disorder. Of the subjects 12.5% reported only one attack in the last year, but 7% reported two attacks and 3.1 % three or more attacks.

Are infrequent panic attacks the same as those that are experienced more often? Katerndahl (1990) found no clinical distinction between frequent (occurring at least weekly) and infrequent panic attacks. When comparing limited symptom panic attacks (those with fewer than four symptoms) with full-blown attacks, symptom frequencies were greater for the full-blown attacks except for the specific fears of impending doom. Phobic avoidance did not differ for limited symptom and full-blown attacks.

From a cognitive perspective PD is an interesting phenomenon. It is thought that panic attacks in PD may be triggered by interpretation of internal rather than external stimuli as threatening. For example, a spider phobic may have a panic attack when he/she sees a spider. In PD, the cognitive model of panic proposes that, in the development of a panic attack individuals fix their attention on their bodily sensations, which they then misinterpret catastrophically (Sokol, Beck, Greenberg, Wright and Berchick, 1989; Clark, 1986). For example, an individual may focus on their heart rate and fear that they are going to have a heart attack.

Cognitive therapy for panic attempts to break this vicious cycle by modifying the meaning taken from bodily sensations (Sokol *et al.*, 1989). Cognitive/behavioural therapy helps an individual to become aware of their automatic thoughts, identify the cognitive distortions in their thinking and to test the validity of the perceptions (Bowers, 1986). Bowers (1986) points out that distortions are common among all persons, but that they seem to be more prevalent in individuals with depressed or anxious mood, with the pessimistic or rigid thinking contributing to feelings of worthlessness or hopelessness.

The importance of cognitions is at yet unknown in the maintenance and treatment of panic disorder. The evidence for the cognitive/ behavioural model of anxiety rests on the effectiveness of cognitive behavioural therapy for the disorder. As the treatment for anxiety disorders currently is most commonly cognitively based, it seems imperative to be able to monitor cognitive change beyond a purely superficial self-report level (cognitive products). The modified Stroop task is an attempt to measure change in cognitive structures.

The Stroop Task

The Stroop task (Stroop, 1935) originally showed an irrelevant cue, a colour name, written in coloured ink, the relevant cue. The words were written in sets on cards. The time the subject took to complete a card by saying out loud the ink colours was recorded with a stop watch. It was demonstrated that subjects' reaction time (RT), or latency, was longer for incongruent colour names than for neutral stimuli. An example of an incongruent colour name would be the word "BLUE" written in red ink. This suggested that somehow the irrelevant colour-name words had interfered with the cognitive process of producing the ink colour name (Hope *et al.*, 1990). This basic effect holds true even though the Stroop task has been replicated using a wide variety of modifications. Recently micro-computers have been used to present the stimulus words and to record response times for individual words. Similar interference results have also been produced using other forms of relevant/irrelevant cue tasks such as dichotic listening and signal detection tasks (Hope *et al.*, 1990). MacLeod (1991) suggests that modifications only modestly affect the magnitude of the results, not their qualitative form.

Explanations of the Stroop effect

The Stroop task tells us something about human information processing, but there is some debate about the nature of this information. What exactly is the interference factor? MacLeod (1991) isolates 18 empirical results that must be explained by any successful account of the Stroop, including, explaining auditory analogues of the Stroop, the lack of gender differences, and decreases in interference with learning and with age up to 60 years.

One early explanation is in terms of perceptual encoding. Encoding refers to the transformations performed on a stimulus before it assumes its final representation in memory (Simon and Berbaum, 1990). Interference at

encoding is caused by the semantic colour name distracting attention from the ink colour (Simon and Berbaum, 1990). This theory has trouble explaining many of MacLeod's 18 findings so it is likely that processing subsequent to encoding is the key to the Stroop effect.

Accordingly, most explanations have been in terms of "late selection", with the conflict occurring late, rather than early, in processing (MacLeod, 1991). The relative speed of processing and the automaticity theories are examples of late selection and also reflect how Stroop himself interpreted the data in 1935. Relative speed of processing holds that words are read faster than colours are named. This is particularly critical when the two potential responses compete to be produced. Interference is the time cost of this competition (MacLeod, 1991). This theory fulfils 15 of 18 MacLeod's criteria.

Automaticity theory is rooted in Cattell's (1886) work (in MacLeod, 1991). Cattell proposed that one dimension requires greater attention than another to process. Words are read very automatically whereas colour naming requires rather more attention. Automaticity develops with learning. More automatic types of processing (word reading) can interfere with less automatic types of processing (colour naming) but not vice versa (MacLeod, 1991). This theory stands up to more rigorous testing than the previous one, but it still requires further fine tuning, according to MacLeod (1991).

Another explanation is in terms of response competition (Simon and Berbaum, 1990). This suggests that the Stroop effect is due to the amount of congruence between the relevant and irrelevant cues in the stimulus. Because the two cues (ink colour and colour name) belong to the same schema, colour, activation spreads easily to the irrelevant cue as well as the relevant one (La Heij, Happle and Mulder,1990).

Newer models are beginning to look at processing in a parallel rather than sequential model form. By doing this they discard the idea of a limited-capacity response stage (MacLeod, 1991). The parallel distributed processing

model (Cohen, Dunbar and McClelland, 1990) incorporates many of the ideas in relative speed and automaticity models but few of the shortfalls. The theory proposes that processing occurs along pathways of different strength, rather than speed of processing being the key factor. "Processing occurs by the spread of activation along connections that exist both within modules and between modules.... Thus if two pathways are active simultaneously and produce conflicting activation at their intersection, interference results." (MacLeod, 1991. p.192). This model nicely incorporates attention, which tunes or modulates the operation of processing units in a pathway. Today most psychologists see the Stroop task as measuring attention, not learning, and the interference is associated with deciding which stimuli to attend to, to produce a response (MacLeod, 1991).

The modified Stroop task and psychiatric disorders

In the last decade the Stroop task has been modified to tap cognitive processing in psychological disorders using attentional means. Known as emotional Stroop tasks, the modified Stroop task uses threat words specific to target disorders and looks at the colour naming latency for the threat words compared to control words. Watts, McKenna, Sharrock and Trezise, (1986) point out that the exercise is not the same using threat words instead of colour names because it does not involve the same disambiguating of colour and word colour. In spite of this, the modifications have generally proven successful (Richards and Millwood, 1989).

Specificity of effects

i) *Generalised Anxiety Disorder (GAD)*

Using a modified Stroop task, Mathews and MacLeod (1985) showed that threat words retarded colour-naming to a greater degree in patients with GAD than non-anxious individuals. The subjects had to name the colour that social

threat words (e.g. foolish, embarrassed), physical threat words (e.g. disease, deathbed) and non-threatening control words, were written in. The GAD group were slower for all trials but recorded significantly more interference with the threat words than the control group relative to the responses to the non-threat words. The performance of all anxious subjects was disrupted by social threat words, while only some were disrupted by physical threat words as well.

This experiment was replicated by Mogg, Mathews and Weinman, (1989), who found a similar general effect, but with differences in detail. Mogg *et al.*, (1989) found that social and physical threat words were relatively independent of each other and related to the subject's predominant worry at the time.

Martin, Williams and Clark (1990, Exp. II), looked at the distinction between anxious patients and anxious non-patients. Twelve outpatients (nine female, three male) meeting DSM-III criteria for GAD, were compared with twelve anxiety-matched non-patients. There were several significant findings. GAD patients were slower in overall colour naming, consistent with Mathews and MacLeod's (1985) findings. There was also an interaction between group status and word valence. Patients were slower at naming threat words than non-threat words while the non-patient group tended, conversely, to be slower at naming non-threat words than threat words. This finding suggests that not all anxious people selectively attend to threat, but this process is a variable which is correlated with being anxious and a patient (Martin *et al.*, 1990).

Martin *et al.*, (1990, Exp. IV) took a closer look at the mechanism behind the Stroop test interference effect in anxious individuals. They tested three hypotheses to explain the longer latencies for colour-naming threat words in anxious patients, in a series of three experiments. The first hypothesis was that anxious patients find the words upsetting and the distress slows down their

colour naming response. The second hypothesis was that anxious patients have a lower threshold for detecting threat material and hence the words have longer to interfere with the colour naming response. The final hypothesis was that once anxious subjects detect threat information they tend to focus their attention onto it and dwell on it. The first hypothesis was discarded, but the results failed to distinguish between the remaining two hypotheses, so the mechanism for the Stroop task interference remains open to further research.

Martin *et al.*, 's (1990) third experiment was designed to determine whether the attentional bias is specific to threat related material (threat hypothesis) or extends to both positive and negative emotional material (emotionality hypothesis). Previous studies have tended to confound emotionality and threat. The researchers used the manual card and stop-watch method of administration, pioneered by Stroop (1935). To ensure compairability with previous studies the stimulus words were those used by Mathews and MacLeod (1985). Two different control cards were used. One card was made up of neutral words, that is, they were rated as neither positive or negatively emotional. The other control card was made up of positive non-threat words which were rated as being as emotional as the threat words. GAD out-patients were the subjects. The results were as predicted by the emotionality hypothesis. The patients the colour-naming latencies were not significantly different between threat and positive cards but were significantly slower for the neutral words. The control subjects produced no significant differences between the cards.

As well as GAD, the Stroop task has been used to look at cognitive processing in depression, phobias, trauma victims, eating disorders and panic disorder.

ii) *Depression*

Williams and Nulty, (1986) used an emotional Stroop task with a sample of depressed patients and found that depression was associated with interference in the colour-naming of negative compared to neutral words.

iii) *Spider phobia*

Research with individuals with spider phobia has shown that selective processing effects do change in the expected direction with treatment. Stroop task interference of spider-relevant words were significantly reduced on a spider-relevant Stroop task after desensitisation (Watts *et al.*, 1986). This suggests that the Stroop effect is not due merely to differences in familiarity with the stimulus material.

iv) *Rape survivors*

Foa, Feske, Murdock, Kozak and McCarthy, (1991) investigated the selective processing of threat information in rape survivors, with or without post traumatic stress disorder (PTSD) and non-traumatised control subjects, with a modified Stroop procedure. The researchers used four sets of words; rape-related threat words, general threat words, neutral words and non-words. The words were presented in random order onto a computer screen. A voice activated relay was used to measure colour-naming latencies. No main effect of group was detected. There was a main effect of word set. Post-hoc analysis showed rape-related words produced significantly longer colour naming latencies than the other word sets for the PTSD group. No Stroop task interference was found for rape survivors without PTSD or the non-traumatised controls. These results suggest that selective processing is a feature of PTSD, rather than simply of prior exposure to rape (Foa *et al.*, 1991).

v) *Eating disorders*

Ben-Tovim, Walker, Fok and Yap, (1989) found that women suffering from anorexia and bulimia were significantly retarded in reaction times for colour-naming food words compared with controls. Reaction times of bulimic women were similarly retarded on shape words. Fairburn, Cooper, Cooper, McKenna and Anastasiades, (1991) found that females who suffered from bulimia were slower than controls to colour name words relating to shape, eating and weight. Both studies used the card method of presentation. Words were presented in a fixed order, with the target card presented last. This meant that the results may have been reflecting fatigue rather than selective processing. Cooper, Anastasiades and Fairburn (1992), again studied the areas of eating, shape and weight words with a sample of bulimic women and controls. This time the words were presented on three cards (target, control and conflicting colour), in a random order to control for fatigue effects. They found that the target card caused significantly greater interference in the bulimic group than in the controls, whereas the conflicting-colour card caused a similar amount of disruption in both groups (Cooper *et al.*, 1992).

vii) *Panic disorder (PD)*

Hope *et al.*, (1990) used a Stroop task to test an hypotheses derived from Beck et al.,'s (1985) cognitive theory of anxiety disorders. The researchers found, as predicted, that subjects who were socially phobic produced longer colour-naming latencies for social threat words and PD subjects produced longer latencies for physical threat words.

Ehlers, Jurgen, Davies and Roth (1988, Exp. I) studied subjects with PD and compared them with non-anxious controls, using the manual card system. Ehlers *et al.*, (1988) hypothesised that the likely threats for those with panic attacks would be physical threat (eg. disease, fatal), separation fears (eg. separation, lonely) and embarrassment related (eg. stupid, humiliation). The

main effects were not significant. There was a significant interaction effect between group (PD and controls) and valence (threat and non-threat words). The trend was for the patients to be slower and the controls to be faster at naming threat words compared to non-threat words. Post-hoc analyses looking at the interaction effect found a significant effect for physical threat words but not either of the social threat categories. Of interest, none of the correlations of the Stroop RT results with the Speilberger State-Trait Anxiety Inventory (STAI) (Speilberger, Gorsuch, Lushene, Vagg and Jacobs, 1983), the Beck Depression Inventory (BDI, Beck, Ward, Mendelson, Mock and Erbaugh, 1961) or the Mobility Inventory (Chambless, Caputo, Jasin, Gracely and Williams, 1985), were significant (Ehlers *et al.*, 1988).

Ehlers *et al.*, (1988) Exp II. compared non-clinical panicers, (individuals who had experienced at least one panic attack, but did not meet the criteria for PD), and non-anxious controls, recruited from undergraduate psychology classes at a University. The researchers wanted to rule out possible sampling biases associated with clinical samples, such as factors related to seeking help rather than factors relating to panic attacks. The procedure involved an experimenter who was blind to the diagnostic status of the participants to control for demand characteristics. Of the main effects, valence (threat/non-threat words) was significant but the group effect was not. There was a significant interaction effect of group and valence. Both non-clinical panicers and controls took longer to colour name threat words than non-threat words. In a recognition task both groups identified more threat than non-threat words (Ehlers *et al.*, 1988).

Ehlers *et al.*, (1988) conclude that the results, taken together, are consistent with the interpretation that persons with panic attacks differ from normal controls in their attention bias to threat-related material, but suggest caution because of the tenuous nature of the findings. In fact, no group effects

were significant on their own. They found that the standard deviations were very large, especially for the non-clinical panic group.

Ehlers *et al.*, (1988) report, that in an earlier unpublished study by the same researchers, they had failed to find any significant major findings with the Stroop task and PD sufferers. They suggest that this was due to methodological shortcomings. Possible shortcomings were that; a) sequential colour names sped up average reaction times on some cards, and b) the use of three instead of eight column cards and larger letters which may have meant that the gestalt word could be missed as the colour might have been overwhelming (Ehlers *et al.*, 1988). The choice of threat words may also have been at fault, as panic has moved away from being conceptualised as separation anxiety. Currently PD is conceptualised in terms of the cognitive misinterpretation of somatic cues (Clark, 1986).

Of interest was Ehlers *et al.*, (1988) attempt to monitor physiological change accompanying the presentation of threat words. Skin conductance levels and heart-rate recorded were recorded continuously through the Stroop task administration. In the unpublished study, differences in physiological responding reached significance, with patients but not controls having a larger skin response when colour naming threat words than non-threat words. In the first published study this finding was not replicated and physiological monitoring was abandoned in the second study without providing any rationale for studying it in the first place. A physiological response to threat words would make the validity of the Stroop task stronger, as it would demonstrate that threat words were having a different impact on the individual than the non-threat words, at an unconscious level. The multi-channel theory proposes that cognition, emotion and arousal are all closely linked and therefore a change in one is likely to be reflected in the other systems, particularly in state anxiety.

McNally, Reimann and Kim (1990) report a methodologically stronger experimental look at selective processing of threat cues in panic disorder with or without agoraphobia. The researchers wished to test the familiarity theory, which suggests that the emotional Stroop task results could be obtained due to people with a certain disorder being more familiar with threat words relating to that disorder, than people without the disorder would be. In this experiment PD patients were compared with clinicians, who would be equally familiar with the threat words. Words used were neutral (eg typical), fear words (eg. panic), bodily sensation words (eg. heartbeat) and catastrophe words (eg. heart attack). A microcomputer and a voice activated relay were used to display words and record responses. The words appeared randomly, in 0.8 cm. block letters, with a three second inter-stimulus break, four times in each of the five colours, and a reaction time was recorded for each word occurrence. Patients were slower than controls in reacting to all stimuli. There was a main effect of word type. Post-hoc Newman-Keuls analyses indicated that catastrophe words produced more interference than bodily sensation, fear or neutral words, although bodily sensation and fear words produced more interference than neutral words. The effect of group (PD/control) was also significant, with the magnitude of the interference effect being less for the clinicians than for the patients. Familiarity cannot therefore fully account for the attentional bias associated with PD (McNally *et al.*, 1990).

The researchers suggest that the reason for a lack of magnitude of effect was the "practice effect" which meant that the amount of interference declined over trials for each group. There was a significant effect of trial blocks which showed less interference at the end of the experiment compared to the beginning. The researchers suggest that habituation to the semantic content of the stimuli occurs over repeated exposure to the target words (McNally *et al* ., 1990).

McNally, Reimann, Louro, Lukach and Kim (1992) compared patients suffering from PD with normal controls and those suffering from Obsessive Compulsive Disorder (OCD) on a modified Stroop task. Positive emotional words were included along with the stimulus words used by McNally *et al.*, (1990), of fear, sensation, catastrophic and non-lexical stimulus words. OCD subjects did not differ from PD subjects, producing longer colour naming latencies for bodily sensation and catastrophic words than positive and fear words. The effects of physiological arousal on the Stroop effect were explored using high (exercise) and low arousal conditions. The researchers found that exercise induced arousal did not enhance Stroop interference for threat words. This may be due to the source of the arousal being obvious (McNally *et al.*, 1992).

The relationship of state and trait anxiety to the Stroop task

Many studies have considered the relationship of state and trait anxiety to performance on the Stroop task measured by the STAI (Speilberger *et al.*, 1983). State anxiety is a current measure of anxiety level. It may be seen as an unstable cognitive product with a test/retest reliability of around 0.16 to 0.62 (Speilberger *et al.*, 1983). Trait anxiety is a more general index of anxiety vulnerability, conceptually a cognitive structure, with correlations of 0.69 to 0.76 for test/retest reliability (Speilberger *et al.*, 1970).

Mathews and MacLeod (1985) found that state anxiety was the best predictor of an interference effect of threat words. However, Mogg *et al.*, (1989) found that trait, rather than state anxiety was the most important predictor of threat word interference. This is in line with the idea that the interference in colour naming threat words reflects a stable bias in construct accessibility in anxiety-prone individuals rather than a transient mood based disturbance (Williams and Nulty, 1986). Unlike Mathews and MacLeod (1985), Mogg *et al.*, (1989) had the questionnaires completed at the end of the Stroop task rather

than before it, which may account for a difference in state and trait anxiety. Before the Stroop task, the questionnaire is likely to tap into anticipatory anxiety. It appears that an anxious mood state is not necessary for the attentional bias to operate, and that danger schemata are in a relatively permanent state of activation (Ehlers *et al.*, 1988).

Martin *et al.*, (1990, Exp. I) used normal subjects with low, medium and high STAI anxiety scores, on a modified Stroop task. No attentional biases were detected. This does not prove the absence of a response, as other studies have found differences in non-clinical populations. It seems unlikely that selective processing is specific to clinical populations (Martin *et al.*, 1990).

Richards and Millwood, (1989) administered a Stroop task to normal women subjects with low and high trait anxiety measured by the STAI. Threat, pleasant and neutral words were presented via a microcomputer, which recorded RT's latencies when the subject manually pushed a button to identify the colour. Richards and Millwood (1989) found that the procedure was robust enough to pick up differences in cognitive bias in a non-clinical population. The low trait anxiety group performed similarly for all three types of stimuli, whereas the high trait anxiety group had short latencies for pleasant stimuli and longer latencies for threat-related stimuli.

The relationship between interference and recognition tasks

Interestingly, greater interference of threat words for the anxious subjects does not necessarily facilitate later recognition memory of the threat words. No difference in accuracy of recognition was found between anxiety and control groups by Mogg *et al.*, (1989) and Mathews and MacLeod (1986). Richards and Millwood (1989) also found no difference in recognition sensitivity between normal subjects with low and high trait anxiety. This suggests a dissociation between biases in perceptual and memory aspects of cognitive processing (Richards and Millwood, 1989). In contrast, Rusted and

Dighton (1991) found that spider phobics were more likely that non-phobics to recall spider-related information from text. There is however some difference in the type of material encoded, explicit versus incidental. In Stroop tasks the subject is not directly focusing on the content of words, however, in tasks of reading text they would be.

Methodological differences in the Stroop task

There is no one standard form of the Stroop task for use in research with anxiety and other disorders. Included in the choices that are available for running a Stroop task are;

a) whether to use sets of words on cards and a sum RT measure for a whole card using a stop watch, or to completely randomise word order, using computer presentation, with each word's RT latency recorded separately,

b) whether to use verbal or manual responding,

c) whether to use control words of neutral, nonsense or pleasant words,

d) the order of the Stroop and questionnaire tests.

The current researcher favoured the random ordering of words on a computer for greater accuracy of recording response times, and to control for some activation spread to similar words in a set. Verbal responding seems a purer measure than physical responding, which is dependent on motor speed. McNally *et al.*, (1990) found that errors were rare using a voice activated relay, affecting only 4.3% of the trials, with that data then excluded from analyses. Errors either occurred because a relay was tripped prematurely, or a subject responded too quietly to trip the relay.

Pleasant words have been found by Richards and Millwood (1989) to provide the most contrast in comparison to threat words and so make a significant result more likely than apparently neutral words.

The Stroop task should be done before any of the pen and paper tests, except in the present study, the Mill Hill vocabulary test (1976), so if there is

some overlap between the content of the questionnaires and the Stroop words this will not confound the results of the Stroop task. State anxiety needs to be measured immediately after the Stroop task, so that it measures current anxiety, not anticipatory anxiety.

Franzen, Tishelman, Sharp and Friedman (1987) looked at the test-retest reliability of the Stroop colour-word test used in neuropsychological settings and came to the conclusion that it was adequate in terms of both correlation between occasions and changes in level. They caution, however, that the patient should have adequate exposure to the Stroop task in order to reach the asymptote of their responding ability before the data is recorded. This suggests that adequate time needs to be spent in practice items on the Stroop. Watts *et al.*, (1986) also examined the test-retest properties of various Stroop tasks and came to the conclusion that it could be a reliable instrument with few practice effects if equivalent, not identical forms were used. Hence for retest purposes the current study used two equivalent set of words, (forms A and B).

Choice of words

Martin *et al.*, (1990) provide what appears to be the most up to date list of words for use in a Stroop task with anxiety sufferers, taking into account the emotionality hypothesis. In Exp. IV Martin *et al.*, (1990) concluded that anxious patients selectively attend to certain types of both positive and negative emotional material. The emotionality of the words used in other studies was rated by subjects using two different methods. This is a step forward as in the past intuition seems to have played a major part in the selection of words. It was found that in five out of six studies direct emotionality ratings for the threat words were significantly higher than direct emotionality for the non-threat words. This suggests that the emotionality hypothesis is a plausible explanation of the Stroop effect. Most studies have used threat words that anyone would find threatening, but a true Stroop effect

is more likely to be found using predominantly non-threatening material that patients erroneously perceive to be threatening.

It is possible that the emotionality hypothesis may hold for PD, where positive emotions can bring about the feared somatic sensations in the sufferer so that they may avoid feeling relaxed, exercising, or any extreme emotion, either positive or negative. In PD such emotionally arousing words might also be considered threat words. Martin *et al.*, (1990) state that " No one as yet has reported a study which includes threat words which are idiosyncratic to a specific disorder and positive control words which (on non-patients ratings) are as emotional as the threat words." p158. The current study used Martin *et al.*, 's (1990) general and social threat, neutral and positive words, adding new words specific to PD, in terms of catastrophic, somatic sensations and agoraphobia. These were generated from descriptions of panic symptoms and agoraphobic situational cues in Beck *et al.*, (1985).

Assessment of cognitions in anxiety disorders

Normally cognitive assessment of an anxious patient before and after treatment is based on pen and paper, subjective, self-report questionnaires. As the answers to the questions come from conscious thoughts, they may be subject to attempts to please the researcher or clinician, or to report symptoms as more impaired or improved than they really are. The Stroop task should not be subject to the demand effects of self-report measures, as subjects feel that they have little or no control over the outcome of the Stroop (Watts *et al.*, 1986).

The assessment of cognitions is a difficult task (Barlow and Cerny, 1988) as cognitions, by their very nature, are bound to fluctuate, with or without treatment. Last, Barlow and O'Brien (1984) attempted to categorise conscious catastrophic cognitions in agoraphobia sufferers and found that cognitions were so transient that their instrument had low test-retest reliability. What

these researchers were measuring was the end product of cognition, or cognitive products. The modified Stroop task, however, is thought to be a current measure of anxious schema and so may tap into something more stable than self-report cognitions, ie. cognitive processing. Given that the Stroop test is reliable (Franzen *et al.*, 1987) it may be a useful supplement to self-report questionnaires.

Examples of attempts to measure anxious cognitions include Chambless, Caputo, Bright and Gallagher (1984), with the Agoraphobic Cognitions Questionnaire (ACQ) and the Body Sensations Questionnaire (BSQ). A problem with these questionnaires is that cognitions and sensations are hard to differentiate. Attempts to test whether cognitions play a causal role in PD by studying whether body sensations are meaningfully related to cognitions, have produced inconsistent results because of the ambiguity and indistinguishability between 'body sensations' and 'cognitions' (Costello, 1992). For example, 'nausea', a bodily sensation, is hard to distinguish from the cognition, 'I am going to throw up' (Costello, 1992). Brewin (1988) argues that people have relatively poor access to describing their mental states and rely on the perception of physiological arousal coupled with an appraisal of environmental observations.

Hope *et al.*, (1990) provide some suggestions for the practical use of the modified Stroop task. Firstly it could become an additional diagnostic tool as it appears able to differentiate between various disorders. Secondly it could help determine which particular issues should be the focus of cognitive restructuring with particular subjects. Finally if self-schema are important in anxiety disorders then successful therapy ought to change them, and this change should be reflected in the Stroop.

Comparisons of the Stroop task with questionnaire measures

The Stroop task's validity, in terms of what it measures in comparison with standard questionnaires of anxiety and anxious cognitions, has not been assessed except for the STAI (Speilberger *et al.*, 1983), The Mobility Inventory (Chambless *et al.*, 1985), and the BDI, (Beck *et al.*, 1961). There have been conflicting reports as to whether state or trait anxiety is related to the Stoop task (Mathews and MacLeod, 1985; Mogg *et al.*, 1989). The BDI and the Mobility Inventory have not been found to be strongly correlated with Stroop task RT's (Ehlers *et al.*, 1988). More correlations of this sort need to be done before the validity of using the Stroop task as a tool in assessing change in anxious cognitions with treatment can be ascertained.

Aims

This study aimed to replicate the results of Ehlers *et al.*, (1988) and McNally *et al.*, (1990), that show that threat words impair colour naming on modified Stroop tasks in PD patients. A set of threat words was derived specifically for panic sufferers, to test the hypothesis that panic attacks in PD are triggered by misinterpretation of internal stimuli, e.g. heart rate, rather than by external cues. The hypothesis was that panic sufferers will take longer to colour name idiosyncratic threat words to do with somatic stimuli and catastrophic outcomes, than more general physical and social threat words, positive emotional words or neutral words.

Validity of an instrument is how well it measures the construct it claims to measure. Construct validity is supported by high correlations with instruments that are said to measure similar constructs. Predictive validity is demostrated by the ability of the instrument to differentiate between different classes of diagnoses. The validity of the Stroop task was investigated by comparing results; a) from pre to post therapy, to see if change, demonstrated by change in self-report questionniare measures, would be reflected in the

Stroop task results, and b) between clinical and community group panic sufferers, to see if the task could detect differences between patients and non-patients, panicers and non-panicers. This provided a preliminary indication of whether the Stroop task could be seen as a useful tool in clinical diagnosis, assessment and evaluation.

Experiment I. tested the hypothesis that the clinical group undergoing therapy for panic would show a reduction in idiosyncratic threat word interference, in the direction of the neutral control words. The questionnaires used by PMH pre- and post-therapy group could be used as factors indicating whether change had occurred with therapy.

Experiment II. tested the hypothesis that there are differences in cognitive processing between clinical and community groups of panicers, who may suffer panic attacks of a less frequent or severe nature. It was be expected that clinical and community panicers would show similar cognitive processing styles, with perhaps difference in detail. It is also likely that clinical group will have greater co-occurring disorders and medications and so respond slower overall than a community group as found by Martin *et al.*, (1990).

CHAPTER II

EXPERIMENT I-PRE- AND POST-TREATMENT CLINICAL GROUP

METHOD

Subjects

Six male and seven female out-patients at the Adult Speciality Services, The Princess Margaret Hospital (PMH), served as subjects for this part of the study. The mean age of the subjects was 35.92 years. Twelve subjects had met the Diagnostic and Statistical Manual of Mental Disorders, Third edition, revised (DSM-III-R) (American Psychiatric Association, 1987) criteria for PD in the previous year. One subject panicked at a rate below criteria. Eleven of the subjects concurrently met criteria for agoraphobia, social phobia or simple phobia. Other co-existing diagnoses measured by the DIS-III-R, (Robins *et al* ., 1989) were Major Depression (within the last 6 months) for eight patients, GAD for six, Alcohol Abuse for four and Drug Abuse for one. Five males and four females completed an out-patient treatment group, administered by the PMH staff, and were post-tested.

Materials

Two forms of the Stroop test were developed. Form A was used for pre-therapy testing and for the community group. The equivalent form, form B, was used for post-therapy testing to control for habituation to the semantic words. The words for both forms were divided into 7 sets of 10 words (see Appendix I).

1) *general physical threat:* These words were related to physical illness, such as "broken bones", "emergency" and "hospital".

2) *positive emotional:* These words were positive, such as "enjoy", "appreciated", "content" and "relaxed".

3) *somatic:* These words related to somatic symptoms of panic such as "sweat", "trembling", "palpitations" and "nausea".

4) *neutral:* These words did not have an emotional valence. They included "smooth", "woven", "fortify", and "continue".

5) *social threat:* These words were to do with negative social evaluation, such as "criticised", "ignored", "humiliated", "embarrassed", and "stupid".

6) *catastrophic:* These words were based on the fears associated with panic attacks, which include fears of dying, going crazy or losing control. They included words such as "heart-attack", "dying", "crazy" and "lose-control".

7) *agoraphobic:* These words were based on the places that individuals suffering agoraphobia avoid. The words included "supermarket", "restaurant", "alone", "trains" and "tunnel".

The sets of general physical threat, social threat, positive emotional and neutral words were adapted from Martin *et al.*, (1990) and had known emotionality ratings. It was chosen to have ten words in each set, as this was seen as close to Martin *et al.*,'s (1990) twelve word sets and was the limit of specific threat words generated. The three idiosyncratic panic sets introduced in this study were catastrophe, somatic and agoraphobic threat, which were seen as the core fears in panic disorder. These word sets were generated from descriptions of panic and agoraphobic cues in Beck *et al.*, (1985). The word sets were matched in terms of word length. Each set had 3 words of length 9-13 letters (large), 6 words of 6-8 letters, (medium) and 2 words of 3-5 letters (small). This was necessary because of the rather large grid capacities of the computer and the belief that a large word would likely take longer to scan than a small one.

The Stroop words received non-patient ratings for emotionality. Twenty-one University students rated each word on a 5-point Likert scale

from very pleasant to very unpleasant (see Appendix III). This was to aid interpretation of the results as being generated by threat as opposed to the emotionality of the word.

Apparatus

An Apple IIe compatible computer with a colour monitor presented the stimuli to the subject and a Timemaster slot clock recorded the response latency for each word trial. A Philmore GM 60. 50K microphone, was connected to a Lafayette Instruments (Model 6602A) voice activated relay, which was interfaced to the computer through the game port.

The software for the modified Stroop task was written by the researcher in Blankenship Basic using high resolution graphics (see Appendix II). Each of 70 words were presented once, at eye level, on the computer screen. The words were printed in upper-case letters approximately 2 cm. high, in one of four colours; white, orange, blue or green. The order of word presentation and the colour of the words was randomly determined for each subject, with no colour appearing twice in sequence.

The presentation of each word initiated a timing routine which was stopped by the subject's verbal response, which then terminated the trial. The current word would disappear and the next word would appear after an interval of approximately one second.

Measures

Stroop Test

MacLeod (1991) reviews findings about the reliability and validity of the Stroop task which find it to be highly reliable, that is, not influenced by factors between pre and post test. Equivalent forms are suggested by Watts *et al.*, (1986). Validity is a harder question to answer, as it depends on the criterion

being measured. Correlations to self-report questionnaires have generally not been high.

STAI

The State Anxiety component of the State/Trait Anxiety Inventory (STAI), form Y1 (Speilberger, *et al.*, 1983) is a 20 item self-report inventory which measures how an individual feels right at the moment of filling it in. The inventory has 0.83-0.92 internal consistency and 0.40 test-retest reliability (Knight, Waal-Manning and Spears, 1983). High reliability would be expected of trait, not state anxiety. New Zealand norms give a mean score of 29 for adult women in the population (Knight *et al.*, 1983).

Mill Hill Vocabulary Scale

The Mill Hill Vocabulary Scale (Raven, 1976) is a 68 item vocabulary test in two parts. In part A the subject is asked to write down in a few words the meaning of each word. In part B there is a choice of six words for each item, with the subject underlining the word that is closest in meaning to the target word.

Qualitative Questions on the Stroop test

Four qualitative questions about the computer task were asked. Subjects were asked how much control they felt they had over the outcome of the computer task, any strategies used and what they thought the aim of the task was (see Appendix IV). They were then asked to recall as many words as possible that had appeared in the task.

Anxiety Disorders Interview Scale-Revised (ADIS-R),

The ADIS-R (Barlow and Cerny, 1988) is used to collect demographic information, as well as information on the onset of the first panic attack, symptoms involved in typical panic attacks and interference caused by the panic attacks. It was used to screen for the presence of panic/agoraphobia in the community group who were not diagnosed by the DIS-III-R (Robins *et al.*, 1989).

Pre- and post-therapy test battery

Originally it was planned to give a battery of pre- and post- therapy outcome measures. As PMH staff had recently introduced their own set of questionnaires for this purpose, given at assessment, pre- and post-therapy and 3 month follow up, it seemed convenient to make use of these, instead of administering another set. Some difficulties arose due to some subjects having been initially assessed before the questionnaires were instituted, the questionnaire set changing, and a lack of compliance in returning questionnaires. The following questionnaires were used;

SCL-90.

The Hopkins Symptom Checklist-90 (SCL-90) is a 90 item measure of symptomatic psychological distress, where each item is rated on a five point scale (Kendall and Watson, 1989). It has nine sub-scales including a 13 item depression scale and a 10 item anxiety scale (Kendall and Watson, 1989). The SCL-90 has internal consistency correlation of 0.90. The depression sub-scale has a one week test-retest correlation of 0.80 (Kendall and Watson, 1989).

BAI

The Beck Anxiety Inventory (BAI) is a relatively new 21 item anxiety inventory that discriminates anxious from non-anxious diagnostic groups. It

is often used in conjunction with the BDI. The BAI has internal consistency of 0.92 and one week test-retest reliability of 0.75 (Beck, Epstein, Brown and Steer, 1988). The BAI correlates 0.51 with clinician ratings on the Hamilton Anxiety Rating Scale and 0.25 with the Hamilton Depression Rating Scale (Beck *et al.*, 1988). Norms are not currently available.

BDI- Short form .

The 13 item short form of the Beck Depression Inventory (BDI-SF) is a self-report inventory used to screen for depression in psychiatric populations and is derived from the 21 item scale by Beck *et al.*, (1961). Subjects are asked to check one of four items indicating how they feel today. The standard and short form of the Beck correlate 0.96 with each other, and the short form correlates 0.61 with clinician ratings of depression (Beck and Beck, 1972). Beck and Beck (1972) give cut offs of 0-4 for no depression, 5-7 for mild depression, 8-15 for moderate depression and 16+ for severe depression, for the BDI-SF. New Zealand norms from the population of Milton give a score of 10 on the BDI - SF at the 99th percentile of depression (Knight, 1982).

Locus of control behaviour scale, (LCB scale)

The LCB scale (Craig, Franklin and Andrews, 1984) measures the extent to which a person perceives events as being a consequence of his or her own behaviour and therefore potentially under personal control. It includes 17 items which are rated on a six point scale. A one week test-retest reliability score of 0.90 and internal consistency of 0.79 was obtained by Craig *et al .*, (1984). A higher LCB scale score indicates greater externality of control. Chronic agoraphobics generally score high on this scale indicating that they consider part of their behaviour not to be under their personal control (Craig *et al .*, 1984). The LCB correlates highly with personal control items in Rotter I-

E scale (0.70), but not with social desirability in the Marlowe-Crowne Social Desirability Scale (0.2), (Craig *et al* ., 1984).

Procedure

Recruitment and sampling

The researcher obtained Canterbury Area Health Board ethical approval and visitor status at PMH, to allow access to patient information and to sit in on assessments. Data was collected form June to November, 1991. There were two methods of recruitment.

a) The researcher sat in on patient assessments at PMH and asked patients to participate in the study. They were given an introductory letter, and later telephoned to get a response and set an interview date.

b) The researcher had access to current patient addresses and names on the group waiting lists. These individuals were approached by letter and later telephoned to get a response and set an interview date.

Those who declined to take part in the study when approached were eight females and four males with a mean age of 39.33 years. There was no significant difference in age (35.92 agreed, 39.33 declined) or gender (six males and seven females agreed, eight females and four males declined) between those who did and those who did not agree to take part in the study.

Historically approximately 70% of those suffering panic disorder have been women. It was the researcher's intention to only use women subjects, to reduce one possible source of variance. Unfortunately this was not practical as a high proportion of the clinic outpatients were men. However, the Stroop task is remarkable in that it does not appear to show any gender differences (MacLeod, 1991).

Diagnostic interview

Diagnoses for the clinical group were generated from the Diagnostic Interview Schedule (DIS-III-R) (Robins, Cottler and Keating, 1989). The DIS-III-R is a structured interview that leads to DSM-III-R, (American Psychiatric Association, 1987) diagnoses and can be administered by a lay person. The researcher was trained under supervision to give relevant sections of the DIS-III-R. The sections used were Demographics, Panic, Phobias, Generalised Anxiety, Obsessive Compulsive disorder, Depression, Drug and Alcohol. Three in-patients were trialed on the DIS-III-R, with the final interview being supervised. The interview took approximately one hour per subject. The interviews were edited with the aid of the DIS-III-R data entry and verification programme (Marcus, Buka, McEnvoy, Zeena and Robins, 1990) and summary diagnostic sheets generated for each subject.

Inclusion criteria

a) Anxiety Outpatients from PMH, Adult Speciality Services who currently (within the last month) had met the DSM-III-R (American Psychiatric Association, 1987), criteria for panic disorder with or without agoraphobia, i.e. 4 panic attacks in the last month, or one or more attacks in the last month during which time the subject had been in constant fear of having another attack.

AND/OR

b) Were on the waiting list for a Panic or Agoraphobic group.

(In practice this is a severity rating).

Exclusion criteria

Individuals were excluded from the study if they were;

a) currently (within the last 2 weeks) experiencing a major depressive episode.

b) currently (within the last 2 weeks) abusing drugs or alcohol.

c) currently on more than 5 mg. per day of Benzodiazepines.

d) suffering from poor vision or colour blindness.

Current major depressive episode, or current abuse of drugs or alcohol (Gustafson and Kallmen, 1990) may impair reaction times while poor vision or colour blindness would interfere with the differentiation of colours on the computer task. Subjects were not excluded for having past history of major depression or of alcohol or drug abuse, as these commonly co-occur with PD (American Psychiatric Association, 1987).

One subject was excluded because he was currently (within the last 2 weeks) suffering from major depression and also did not meet the DIS-III-R criteria for PD.

Experimental session

Stroop testing took place in a quiet, dimly lit office at PMH. A paper bag was on hand, for the subject to be prompted to breath slowly into, in the event of a panic attack. Every attempt was made to make the participants feel safe and relaxed. The session took approximately 30 minutes per subject. The pre-treatment Stroop task took place either immediately after the diagnostic

interview or up to a week following the interview. After giving informed consent (see Appendix V), subjects were asked about their eye-sight with reference to reading colours from a computer screen. The Mill Hill Vocabulary Scale (Raven,1976) was then administered.

Subjects were seated in a comfortable chair 1.5 metres from the computer monitor, with the microphone beside them. They were shown four colour patches on the screen with the target colour name along side. They were told to expect words to appear one at a time in the centre of the monitor. Subjects were instructed to name the colour that each word was written in, as fast and as accurately as possible, without paying any attention to the content of the word. Subsequently the subjects were given eight practice words from a list that contained neutral words only. They were encouraged to repeat the practice set as many times as they needed to feel comfortable and competent with the procedure, ensuring that the subjects could respond at an optimal level right from the beginning of the task. Subjects were told that the task had 70 words and took about four minutes, and that they should continue to the end. After the practice, each subject was presented with the 70 trial words. The experimenter was in the room throughout the trial to record by hand errors to do with the voice activated relay. Errors resulted from prematurely tripping the voice activated relay or from responding too quietly to trip the relay.

After the Stroop task, some qualitative questions were asked about the task and form Y-1 of the STAI (Speilberger, *et al* ., 1983) was completed. This was done to see if the task induced anxiety which could interfere with the task. Some additional questions on panic history were asked from the ADIS-R (Barlow and Cerny, 1988). This was done to provide information on individual's panic history to compare with the community group.

Therapy was provided independently of the research study. It consisted of either an agoraphobic or panic group lasting around two weeks and based on the Andrews and Crino (1991) Australian treatment program. It included

components of relaxation training, breathing retraining, exposure and cognitive restructuring. Treatment took place in a group of up to ten participants with two co-leaders from Allied Health fields. Those who completed the course completed pre and post-group BDI-SF's, BAI's, SCL-90's and LCB's. The post-treatment Stroop test took place on the last day of the therapy group for each subject and consisted only of the equivalent form (Form B) of the Stroop test.

Debriefing

This occurred after a subject completed post-test questionnaires and was in the form of a letter. Information about the rationale and aims of the study was disclosed. It read like this:

"The research you took part in looked at the way anxious people filter information from the environment. Some of the words on the computer task were threat words like "disease" or "embarrassed". I expected that a certain group of anxious people would have greater difficulty naming the colour of panic referent words than non-anxious individuals would. This is because individuals who suffer from anxious disorders appear to have a method of thought processing which is very quick to pick up things in the environment that may be a threat to them. This bias for picking up threat material interferes with other processing, such as the colour-naming of words. I wanted to compare the results of the Stroop, which you had little control over, with questionnaires that monitored your change with therapy. I wanted to see after therapy an anxious person would begin to thought process more like a non-anxious individual."

RESULTS

Emotionality ratings.

Non-patient ratings of the emotionality of the Stroop words yielded ratings which were significantly different (One-way ANOVA, (df (13, 21), F = 41.527, p< 000)). Post hoc Tukey tests rated the general and social threat words, derived from Martin *et al.*, (1990), as being significantly more unpleasant than the neutral words. The positive emotional words were rated as being significantly more pleasant than the neutral words. The catastrophic sets were also rated as highly unpleasant but the somatic and agoraphobic sets were not rated as significantly different in emotional valence from the neutral words. Therefore, the somatic and agoraphobic words, if processed as threat words by individuals with panic disorder, may be seen as idiosyncratic threat words to these individuals. There were no significant differences in emotionality ratings between any of the equivalent sets in forms A and B, indicating that in terms of emotionality the content of the two forms was equivalent.

Table 1.1. Mean absolute emotionality scores

Stimulus	Form A	Form B
Neutral	3.35	3.18
Positive	4.16	4.21
Agoraphobic	2.92	3.08
Social threat	2.13	1.97
Catastrophe	2.04	1.96
General threat	2.09	2.11
Somatic	2.62	2.57

N.B. Scores can range from 1 (very unpleasant), through 3 (neutral), to 5 (very pleasant).

Stroop test results

Errors of tripping the relay were edited out as missing variables. The error rate for the voice activated relay was under one percent of total word presentations for the clinical group. For each subject the colour naming latencies for the 70 target words, were reduced to seven scores, each score being the median for the 10 words in each category. Means for each subject for each category were also computed. The mean across subjects of the word category median scores was then derived. The mean of median scores, rather than the mean of the mean word category scores, was used in later analyses, to control for outlying data that was causing skew in the mean data (Heathcote, Popiel and Mewhart, 1991). Some other researchers have addressed the problem of outliers by deleting each subject's two longest and two shortest response latencies (McNally, *et al.*, 1992). On average, the mean sub-scale scores were 0.04 sec above the median scores.

A one-way repeated measures analysis of variance (ANOVA) was used to compare differences between RT's for the seven word categories for the 13 subjects in the original clinical group. There was no significant effect of word category, ($F(6,12) = 0.723$, ns.). Also, none of the one-way repeated measures ANOVA's looking at specific threat categories compared with the control categories of neutral and positive emotional words, produced significant results. As shown in figure 1, the differences between word category mean reaction times are insignificant compared to the variance within word categories.

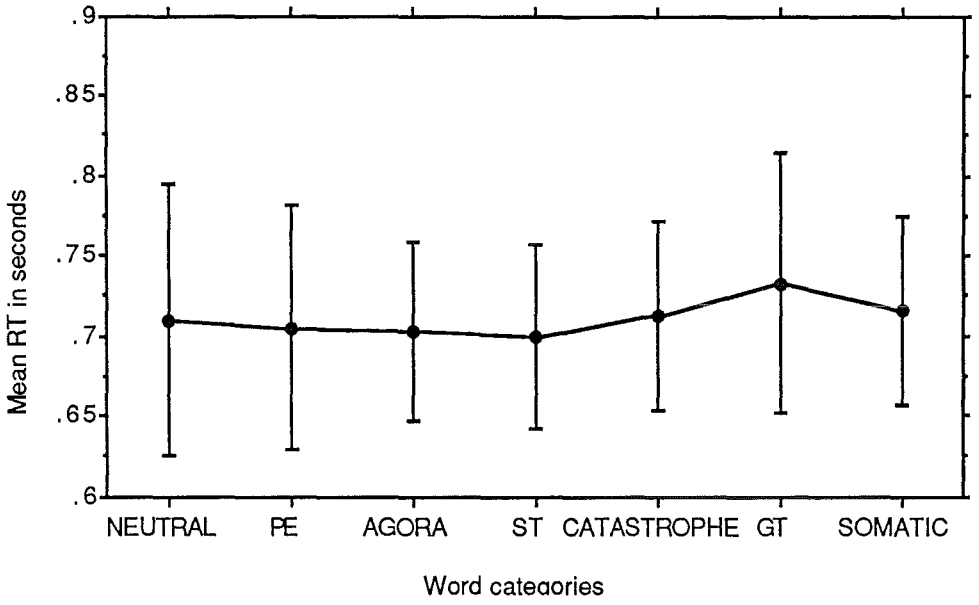


Figure 1.1. Means and one standard deviations bars for colour naming latencies, of 13 clinical subjects, before therapy.

A correlation matrix was used to compare the subjects' number of symptoms for each DIS-III-R diagnostic category and RT latencies for individual word categories. This showed high correlations between different word category reaction times, as might be expected, but random results with DIS-III-R diagnostic categories.

A one-way repeated measures ANOVA comparing reaction times across word categories, was performed on the data from the nine subjects following therapy, also showing no significant pattern, ($F(6,8) = 1.906$, ns, $p<0.099$). When each of the five threat categories was compared with the control categories, of neutral and positive emotional words, only the somatic category produced a significant difference, ($F(2,8) = 3.841$, $p< 0.05$). Post hoc analysis showed that the somatic words (mean = .745 sec.) took significantly longer to colour name than the positive emotional words (mean =.672 sec.).

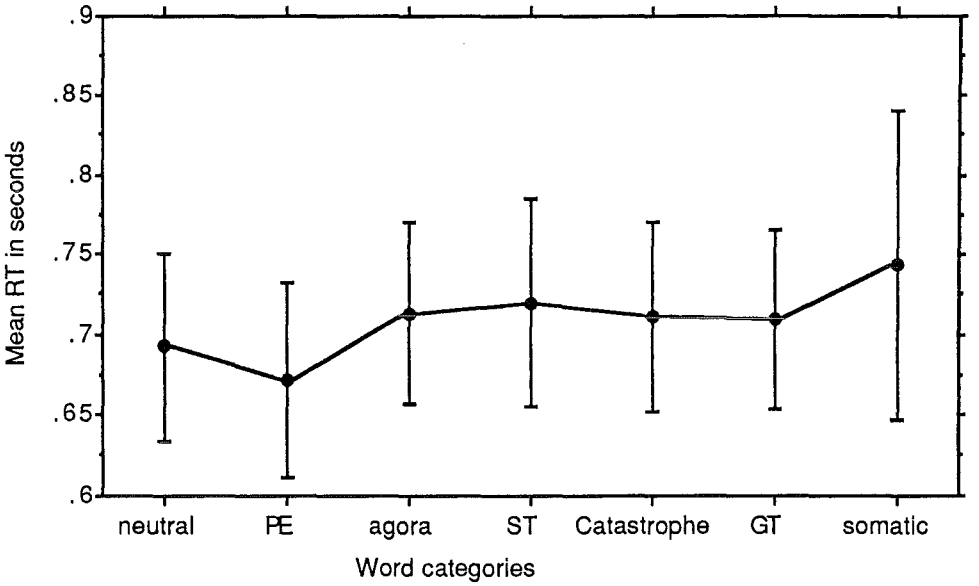


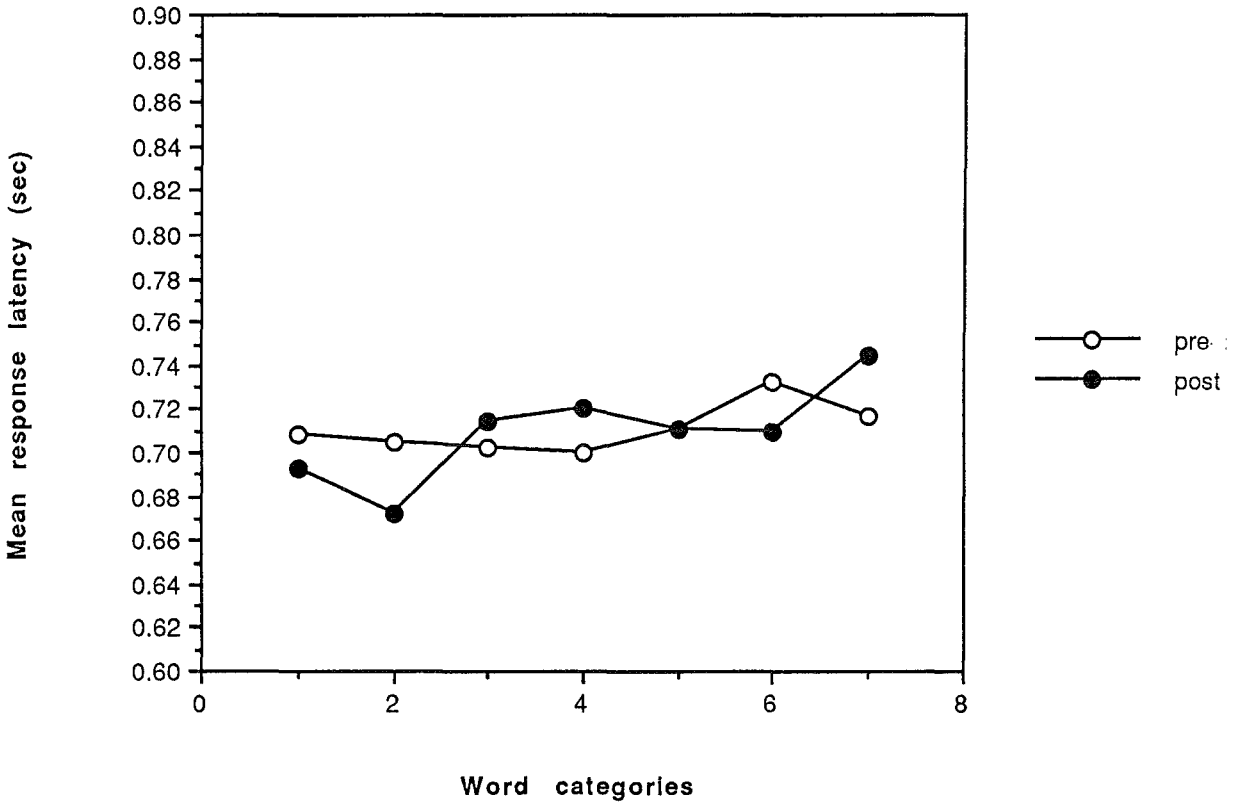
Figure 1.2. Means and one standard deviations bars, for colour naming latencies of nine clinical subjects, after therapy.

Pre and Post clinical scores for the nine subjects followed through a therapy group were analysed by a two- factor repeated measures ANOVA. There was no significant effect of group, word type or interaction between the factors.

T-tests on paired word categories pre- and post-therapy also produced no significant changes in reaction time responding on any of the word types following therapy.

Table 1.2: Mean response latencies, in seconds, before and after therapy.

Stimulus	Pre-therapy (N=9) M	Post-therapy (N=9) M	Grand M
neutral	.692	.693	.693
positive emotional	.704	.672	.688
agoraphobic	.703	.714	.708
social threat	.704	.720	.712
catastrophic	.702	.711	.707
general threat	.715	.710	.712
somatic	.704	.745	.724
Total mean	.703	.709	



Key : 1= Neutral
2= Positive emotional
3= Agoraphobic
4= Social threat
5= Catastrophic
6= General threat
7= Somatic

Figure 1.3 . Mean colour naming latencies as a function of therapy and word type.

In figure 1.3 the range of the means for word categories is much greater in the post therapy group than it was pre-therapy (pre, range = 0.23 sec.; post, range = 0.52 sec.).

Qualitative Stroop investigation (see Appendix III)

Ten out of thirteen subjects used no strategy to focus on the colour and ignore word content. On average subjects reported that they had control on the task at a magnitude of 2.8 on a Likert scale from no control (0) to complete control (4). If they used a strategy to respond to the computer task, subjects tended to think they had more control over the task. Seven people formed hypotheses about the aim of the task during the task, but none of these were correct. On being asked to recall as many words as they could immediately after the task, an average of 2.6 correct and 0.77 incorrect words were recalled. The correct words tended to be threat words, related to the catastrophic, somatic, general threat and agoraphobic categories. No neutral or positive emotional words were recalled. Confabulations also tended to be related to panic threat, eg. "anxious", "fear", "fatigue", "hopeless" and 'aggression".

Questionnaires

STAI

The state form of the STAI scores averaged 42.08 (n = 12). The norms for 40-49 year old working adults in the US place this result in the 76-80th percentile, representing relatively high state anxiety (Speilberger *et al .*, 1983). There were no significant correlations between STAI scores and word category RT's. The results of the STAI and the BAI correlated 0.87 ($p< 0.05$) with each other, as might be expected.

Pre - and post- treatment T-test comparisons

The pre- and post-therapy questionnaires (SCL-90, BDI, BAI and LCB scale), indicated that there was a self-report decrease in the symptoms of anxiety and depression with therapy.

SCL-90

One subject did not complete an SCL-90 post treatment, so the analyses are based on eight subjects. In eight of the nine SCL-90 categories, scores indicated that the degree of pathology decreased significantly following therapy. The only category not to change was that of Anger/Hostility, which is not strictly a psychiatric category. The largest symptomatic decreases were in the Somatization and Phobic Anxiety sub-tests. The Somatization sub-test decreased from a mean of 1.29 to 0.28, ($t(7) = 4.314$, $p < .0018$). The Phobic Anxiety sub-test went from a mean of 1.27 to 0.3, ($t(7) = 3.034$, $p < 0.0095$). The Depression, Obsessive Compulsive, Anxiety, Interpersonal Sensitivity, Paranoid Ideation and Psychoticism sub-test scores also showed significant decreases at the .01 to 0.02 level of significance.

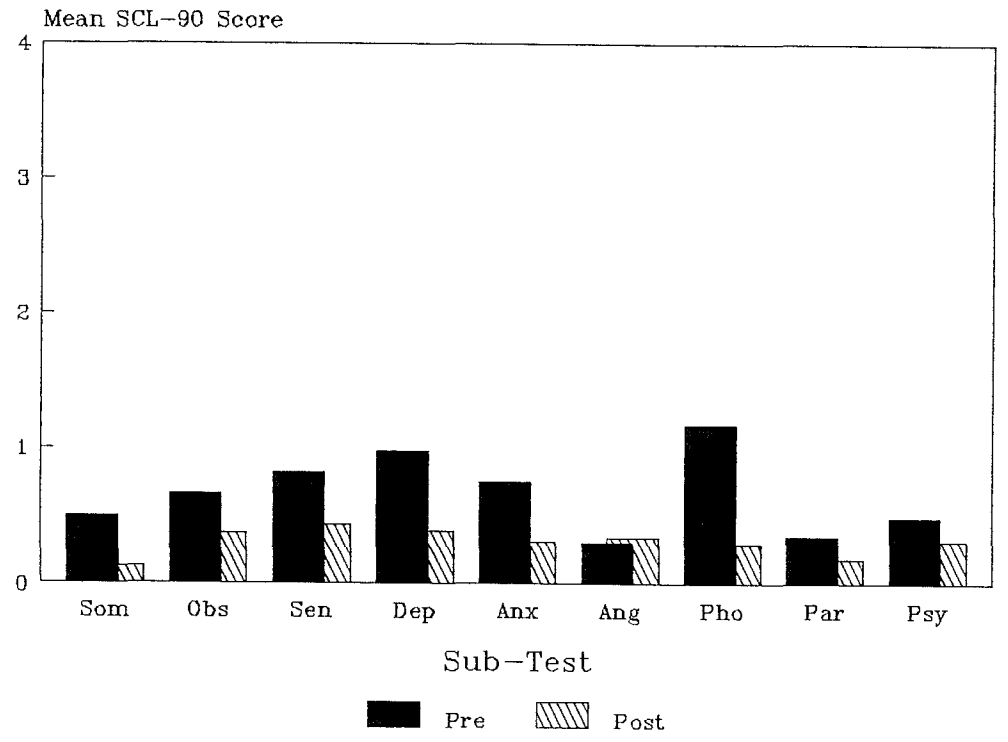


Figure 1.4. Pre- and post-treatment mean SCL-90 scores.

BAI

As three subjects were missing pre-therapy BDI and BAI scores, the analyses are based on an N of 6 for these two measures. One tailed t-tests were used to analyse the change from pre- to post-therapy as it can be predicted that any change will be in the direction of less symptomatology following therapy. Before therapy six subjects had a mean BAI of 21.3. After therapy the mean BAI had dropped to 10.1. This was a significant decrease ($t(5) = 2.655$, $p < .02$).

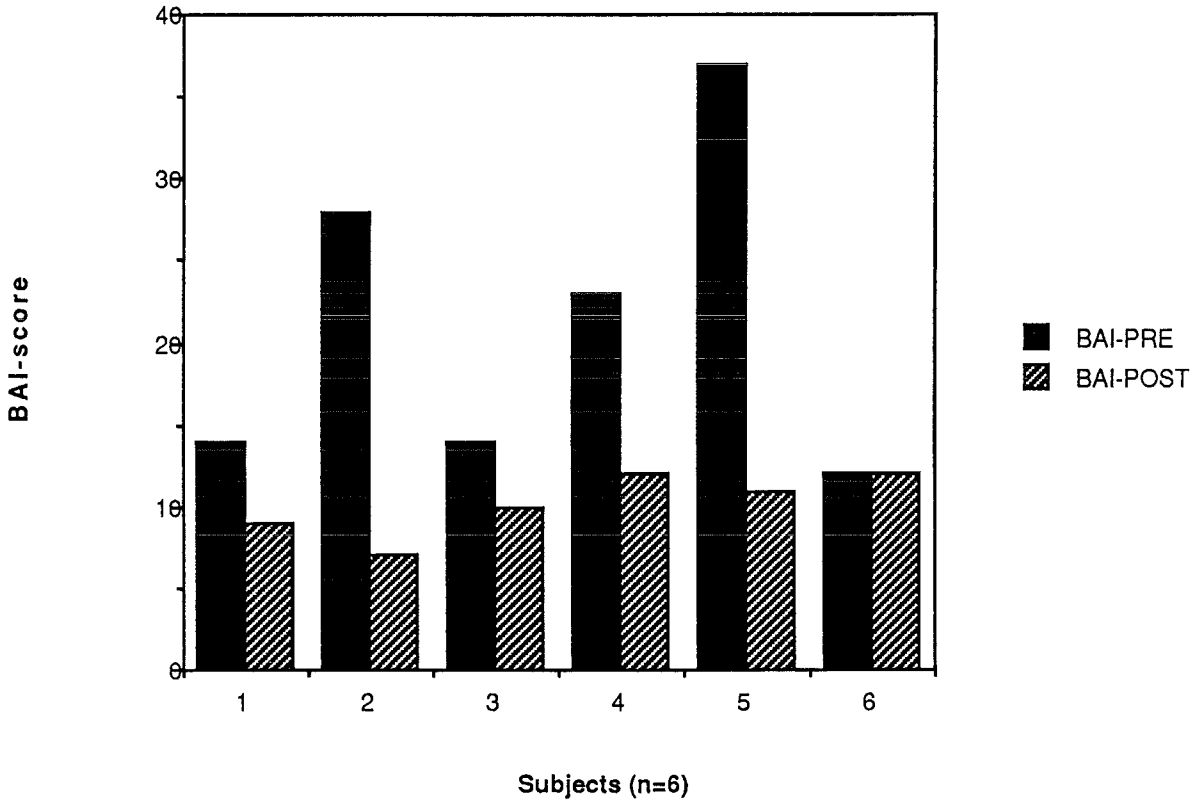


Figure 1.5. Pre- and post-therapy BAI scores for six clinical subjects.

BDI-SF

Before therapy 6 subjects a had a mean short form BDI-SF of 9.8. After therapy their mean BDI-SF was 3.5. This was a significant decrease in reported depressive symptoms ($t(5) = 3.364$, $p < .01$).

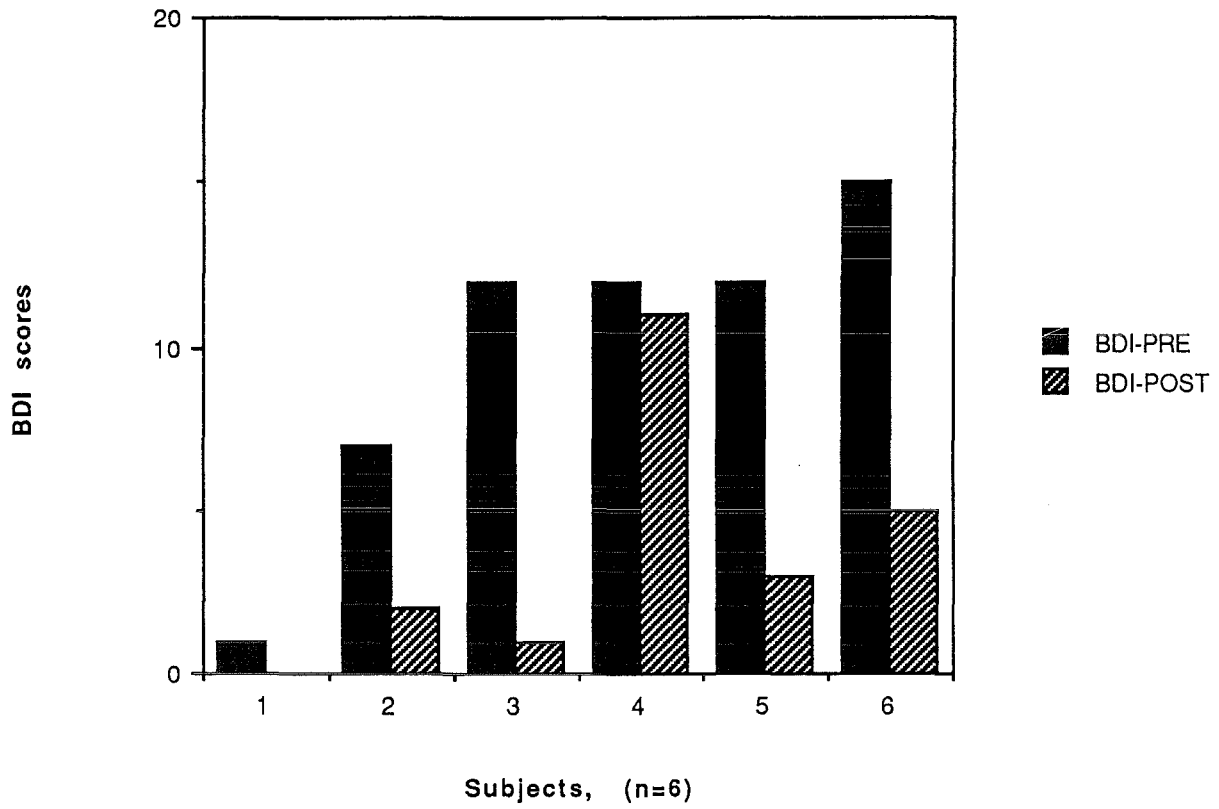


Figure 1.6. Pre- and post-therapy BDI-SF scores for six clinical subjects.

LCB

One subject was missing pre-therapy LCB scale data and another was missing post-therapy LCB data. The analyses for this scale are therefore based on an N of seven. Pre-therapy the seven subjects had a mean locus score of 25.5. Following therapy the mean score had decreased to 22.5. This was a statistically significant decrease ($t(6) = 2.049$, $p<.05$).

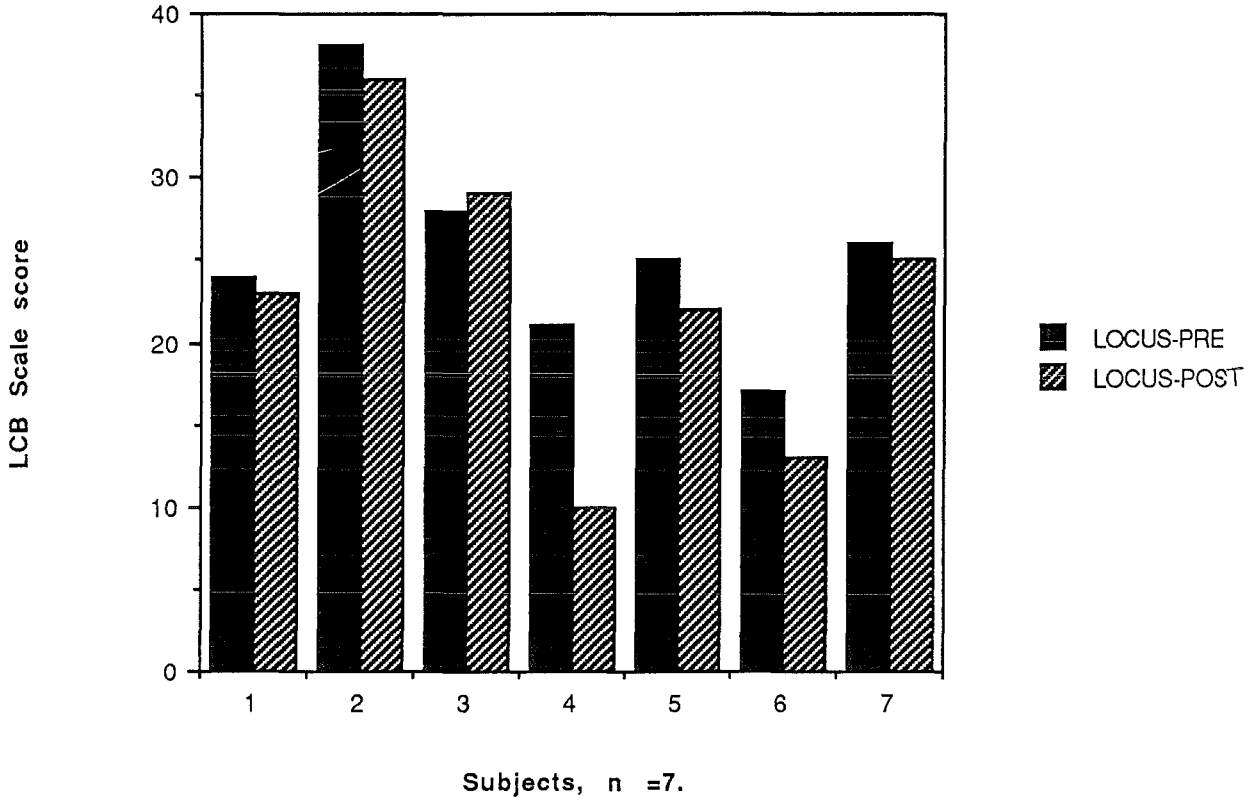


Figure 1.7. Pre- and post-therapy LCB scores for nine seven clinical subjects.

CHAPTER III

EXPERIMENT II- CLINICAL AND COMMUNITY GROUP COMPARISON

METHOD

Subjects

The clinical group consisted of the 13 subjects pre-tested at PMH, and used in Exp. I. Of these, seven were males and six were females. They had a mean age of 35.92. Their mean vocabulary score (Mill Hill Vocabulary Scale, Raven 1976) was 28.5. The community group consisted of 17 volunteers from a Continuing Education course, at the University of Canterbury called, "The Psychology of Panic". The community subjects had a mean age of 38.81, and a mean vocabulary score of 48.87. Two of the participants were male and 15 were female. Ten had met the criteria for PD in their lifetime and had an mean short form depression index of 10.5 (BDI-SF, Beck and Beck, 1972) and a mean anxiety score of 11.1 (BAI, Beck *et al* ., 1988). One subject suffered infrequent panic attacks, and five did not suffer panic attacks. These six subjects had a mean depression index of 2.83 and a mean anxiety score of 2.83. One subject was missing questionnaire data.

Materials

The computer was set up as for Exp. I. The location was at the University of Canterbury in a small office. Form A of the word lists was used, as for the pre-treatment clinical group.

A booklet was prepared consisting of demographic questions, a modification of the ADIS-R (Barlow and Cerny, 1988) for self-report, the Mill Hill Vocabulary Scale, BDI-SF and BAI.

Procedure

Sampling and recruitment of community group.

Community panicers and non-anxious controls were recruited from a Continuing Education course in panic run at the University of Canterbury, November-December, 1991, which had an educational, rather than treatment, orientation. However, the course was still expected to attract individuals suffering from panic and those connected with persons suffering the disorder. Participants were told about the research by the researcher at their first session and asked to fill in a form indicating if they wished to participate and which times suited them best. They were then telephoned by the experimenter to set a time for the experimental session.

panicers

Inclusion criteria

a) Have met the criteria for PD in their lifetime.

controls

Inclusion criteria

a) do not meet the criteria for inclusion into the other group.

Stroop Task

Firstly consent forms were completed (see Appendix V), and subjects were asked about their colour vision. The Stroop task procedure was the same as for Exp. I, although peripheral parts of the procedure were modified. In order to shorten sessions and so make it more attractive to participants, the diagnostic interview was replaced by the ADIS-R, which is designed only to screen for the presence of panic disorder and agoraphobia. The participants were only seen once. The Stroop session took about 15 minutes. A booklet

containing the ADIS-R the BDI, BAI and the Mill Hill Vocabulary Scale was given to the subject to take home and return the following week, either in person or by mail. The questionnaires took a total of approximately half an hour to complete.

Debriefing

The final session of the continuing education course looked, in detail, at literature on Stroop tasks and the rationale behind using this kind of inquiry with panic sufferers.

RESULTS

Demographics / ADIS-R

There was no significant differences between the ethnicity of subjects, the age of subjects, or the age of onset of panic symptoms (ADIS-R, Barlow and Cerny, 1988), between the clinical and community groups. For the community group members who had ever experienced a panic attack (n =11) the onset of panic was at a mean of 22.27 years. For the clinical group with data available (n=9) the onset was at a mean of 25.89 years.

There was a significant difference in the gender compositions of the two groups ($t(28) = -.761$, $p < 0.05$). There were fewer men in the community group sample than in the clinical sample. Another demographic difference found between the groups was in the interference caused by the panic attacks (ADIS-R, Barlow and Cerny, 1988). The clinical group reported significantly greater interference from their panic attacks than the community group panicers ($t(16) = 2.245$, $p < 0.05$). On a scale of 0 (no interference) to 4 (disabling) the community group's mean rating of current interference caused by the panic attacks was 1.68, while the clinical group mean rating of interference was 2.88.

The community group scored significantly higher than the clinical group on the Mill Hill vocabulary scale ($F(1, 25) = 26.41$, $p<0.01$). The community group produced a mean vocabulary score on the Mill-Hill Vocabulary Scale of 48.87 while the clinical group produced a mean score of 28.5. The community group had also completed a higher level of education than the clinical group, ($t(27) = -3.525$, $p < 0.002$). The community group had completed a mean education level of 12.75, (equating to between a seventh form and one year of tertiary education). The clinical group had completed a mean education level of 10.54, (equating to a fifth to sixth form level of

education). It is possible that the Stroop words may have been more meaningful to the community group who had greater education and vocabulary levels, and may have therefore recorded longer colour naming latencies for uncommon threat words.

A correlation matrix of mean RT latencies for word categories with educational level showed no significant correlations. This suggests that educational level is not responsible for a large amount of the variance between the clinical and community groups in reaction times to colour-naming on the Stroop task.

Stroop test results

A repeated measures ANOVA looking at differences across sub-scales for the community group found no significant main effects ($F(6,16) = 1.54$, $p<.1736$, ns). When comparing individual threat categories with the control categories of neutral and positive emotional words, only the somatic word category was significantly different ($F(2, 16) = 3.486$, $p< 0.05$). Post hoc analysis by Fisher PLSD found both neutral (mean = .703 sec.), and positive emotional (mean = .702 sec.) word categories produced faster colour-naming response latencies than the somatic words (mean = .739 sec.).

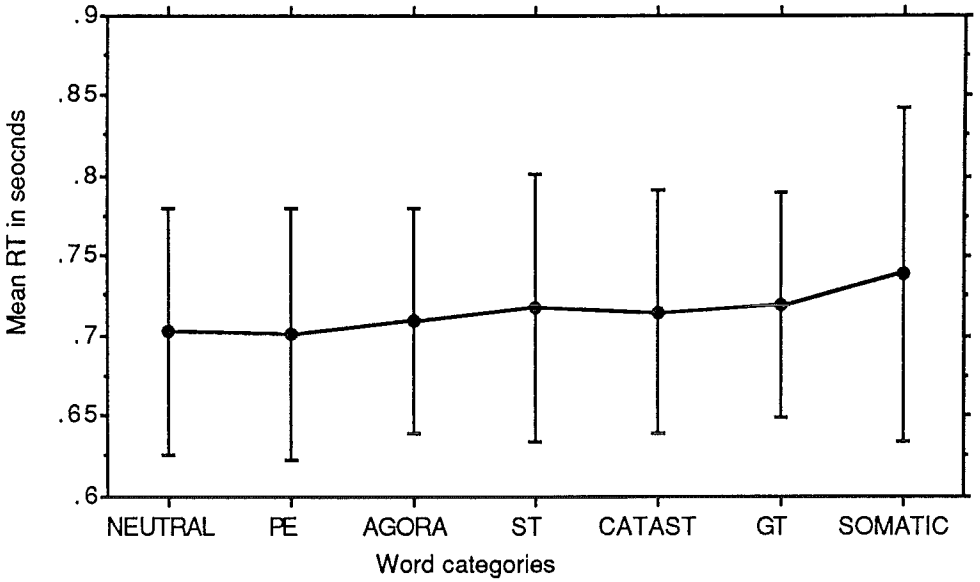
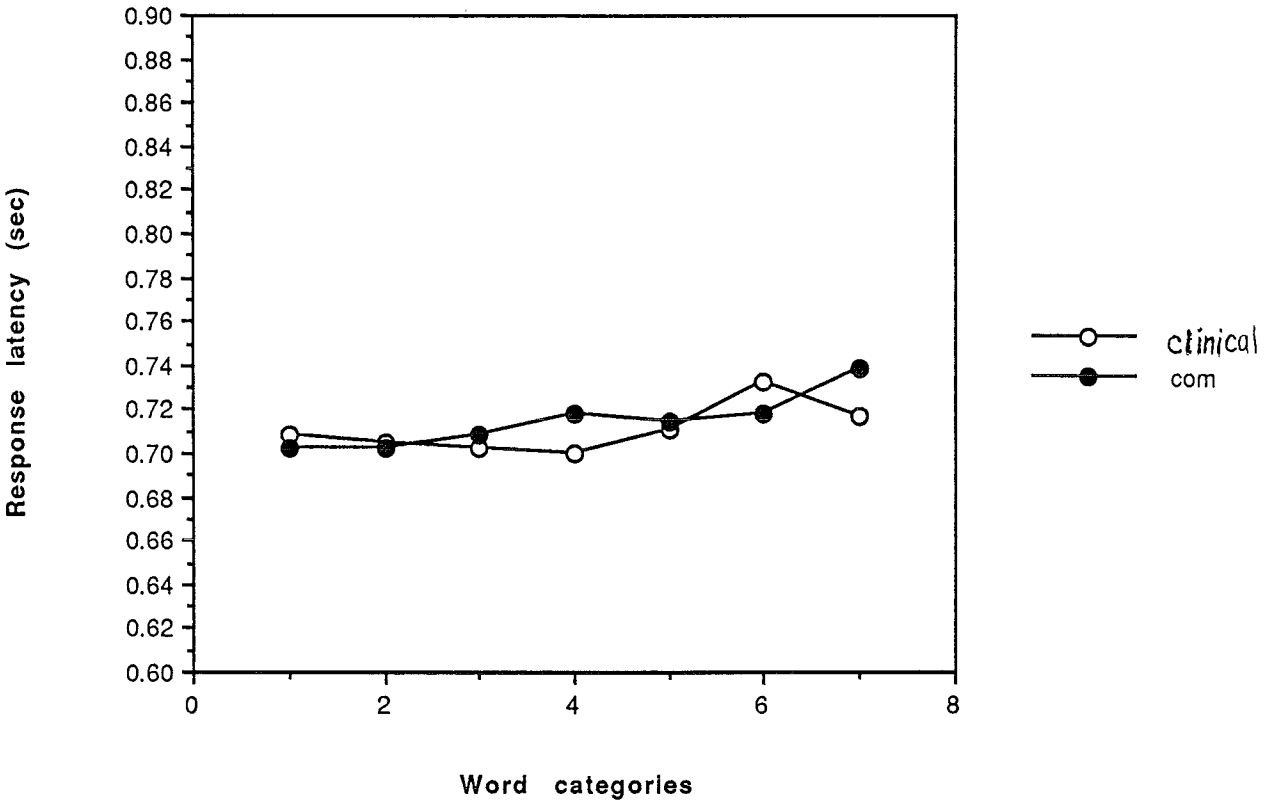


Figure 2.1 . Mean and one standard deviations bars for colour naming latencies of 17 community subjects.

When the community results were compared with the pre-clinical results by two- factor repeated measured ANOVA there were no significant main effects of group, word type or an interaction effect. T-tests looking at the differences for word category on form A, from pre-clinical to community group RT's, found no differences in RT for any of the word categories.



Key : 1= Neutral
2= Positive emotional
3= Agoraphobic
4= Social threat
5= Catastrophic
6= General threat
7= Somatic

Figure 2.2. Mean colour-naming latencies as a function of group, (Pre-therapy clinical and community) and word type.

When the ten community subjects group who meet the criteria for PD were isolated from the seven non-panic controls, and analysed by a two- factor repeated measures ANOVA, there was no significant main effect of word category, group, or interaction effect.

Table 2.1. Pre-therapy clinical group and community group demographics and mean scores on questionnaires.

	Pre- clinical N=(13)	Community N= (16-17)
Age	35.92	38.81
Ethnicity		
European	13	17
Gender		
M	7	2*
F	6	15*
Marital status		
Married	8	7
Single	3	3
Separated	1	2
Divorced	1	4
Education level	10.54	12.75 *
Panic onset	25.89	22.27
Interference	2.88	1.68 *
Vocab score	28.5	48.87 *
BDI	9.8 (N=6)	10.5 (N=10)
BAI	21.3 (N=6)	11.1 (N=10)

* denotes a significant difference at $p < 0.05$.

The panicers among the community group looked very much like the pre-therapy clinical group on the questionnaire measures. There was no statistically significant difference (one-tailed paired t-test) between the 10 community panicers and pre-therapy clinical panicers on either the BDI or the BAI. However, as only six of the clinical group had pre-therapy BDI's and

BAI's the BAI may well have been higher in the clinical group had all of the data been able to be utilised.

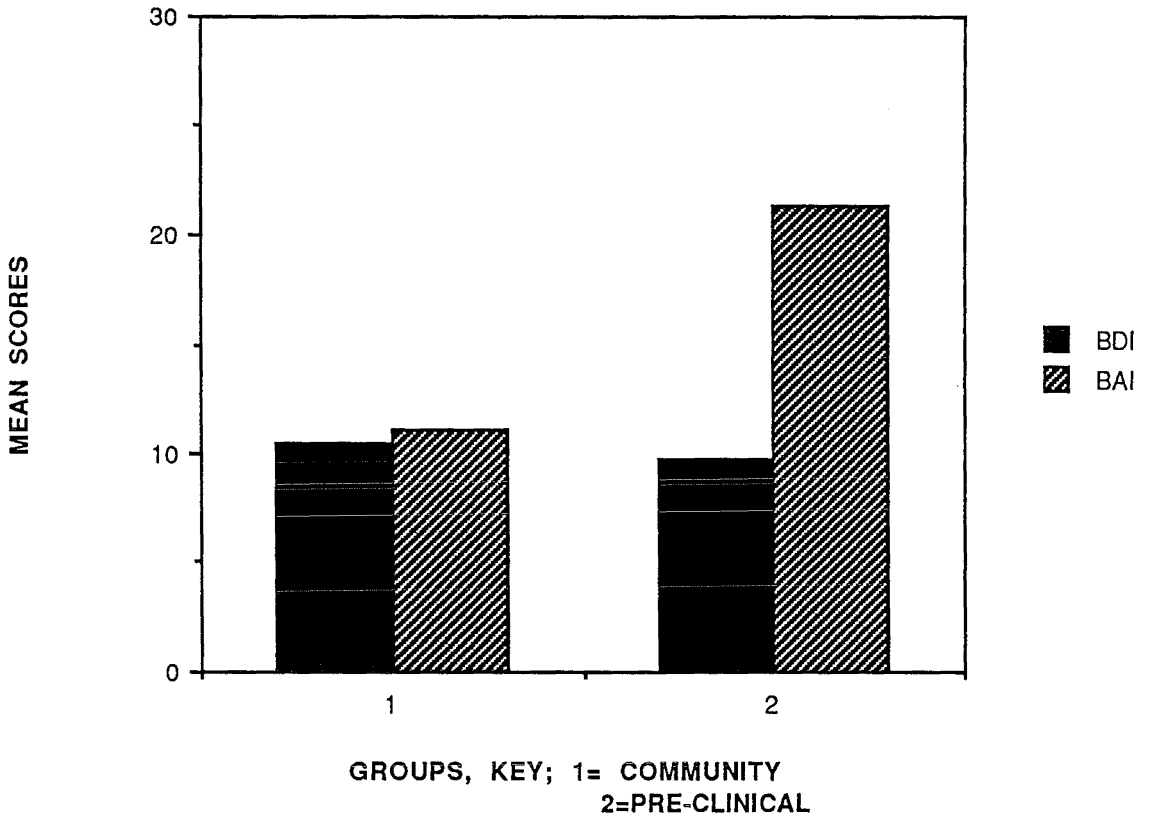


Figure 2.3. Community panicers and pre-therapy clinical group BDI and BAI scores.

BDI and BAI scores were correlated with the word categories RT's in the Stroop test for combined pre-clinical and community groups. A correlation of 0.4227 was needed for statistical significance at the 0.05 level of significance using 20 degrees of freedom (Bruning and Kintz, 1987). None of the correlations approached this level. The BDI and BAI scores also did not correlate highly with each other, suggesting that the measures do indeed tap into different constructs.

CHAPTER IV

DISCUSSION

The most important null finding is that of the pre-therapy clinical group who showed no major effect of word type and also no differences between specific threat and control sub-scales when isolated out, and yet would be expected to be the most symptomatic. In contrast, in both of the post-therapy clinical group and the community group, somatic words produced a significant interference in colour naming compared to neutral or positive emotional control words.

Reasons for the null effect

The first possible explanation for the lack of effect is to do with the nature of the disorder being studied. It may be that GAD is an anxiety disorder more suited to this kind of inquiry than PD. GAD includes hypervigilence as a diagnostic criteria, whereas PD does not. Panic is known for its spontaneous occurrence which may not offer any cues or warning to the individual. It has been suggested that this is because it may be precipitated by biological rather than cognitive factors (Penn, 1991-92). A biologic base in PD is demonstrated by fatigability of panic sufferers, heredity of PD and sodium lactate inducing of panic attacks in susceptible individuals (Penn, 1991-92). Penn (1991-92) suggests that there is little evidence supporting cognitive therapy as a treatment for PD. It may be that PD sufferers are biologically prone to sudden changes in physiological arousal, which is then followed by cognitive interpretation (Penn, 1991-92).

A comparison of the methodologies of similar studies provides another possible explanation for the lack of results. An unpublished study by Ehlers *et*

al., also failed to find any major effects with the Stroop task in PD. Further to this Ehlers *et al.*, (1988), in a revised attempt at studying the Stroop test and PD, failed to find results of the magnitude predicted by studies with other anxiety disorders. However, McNally et al., (1990) did find significant results using the Stroop test with a PD population. Their methodology included using four sets of words and random presentation of words interrupted by an inter-stimulus break of three seconds. The current study involved seven sets of stimulus words separated by an inter stimulus break of one second. These factors may be important in producing a significant result.

The variance among PD sufferers is a third factor that may make significant results unlikely. PD is very variable, and attracts many co-existing disorders, including GAD, social phobias and depression, alcohol and drug abuse. This makes it unlikely to find a strong pattern of processing bias common to all those who suffer panic attacks. Different individuals may have responded to specific idiosyncratic words in a set (e.g. "restaurant" for the man who feared carving hams in view of people at work), rather than the whole set. Individuals may have only four of the somatic symptoms and one catastrophic cognition usually associated with their panic attacks. Individual variance was very high in all of the analyses as shown by the high standard deviations. Ehlers *et al.*, (1988) also comment on the large standard deviations of Stroop reaction times among subjects with PD. It may therefore be more meaningful to look at individual rather than group results. However, there is little to suggest that individual profiles are reliable, since correlations with diagnostic categories did not produce significant results.

At the time of writing this report the Stroop task is not considered the best test of attentional bias (Mineka and Sutton, 1992). More sophisticated methods have been developed that look at anxious patients' attention being diverted towards threatening stimuli when there is a combination of threatening and non-threatening cues in the environment (Mineka and

Sutton, 1992). In a recent example Mogg, Mathews and Eysenck, (1992) showed word pairs on a microcomputer in threat/neutral or neutral/neutral pairings, with a dot probe appearing on 48 critical trials replacing the word until the subject made a response. Subjects, who suffered GAD, were asked to read the upper word aloud and to press a hand-held response button whenever they saw the small dot appearing after one of the words. Anxious patients were relatively faster to detect probes that appeared in the position of the threat words than in the position of the non-threat words, indicating that their attention shifted toward the threat stimuli (Mogg *et al.*, 1992). This study replicated the anxiety bias for physical and social threat words in the GAD population found by MacLeod *et al.*, (1986) using the modified Stroop task.

Sub -scale comparisons

The somatic category caused the largest interference in both Post-therapy clinical group and the community group. In the Post-therapy group the somatic words produced longer latencies in colour naming than the positive emotional words. In the community group the somatic words produced longer latencies than both the neutral and positive emotional words. This suggests that a fear of somatic symptoms is the most salient concern in panic disorders, although not significantly greater than social, physical threat, catastrophic or agoraphobic threat. In contrast McNally *et al.*, (1990) found that catastrophic words produced significantly longer latencies than bodily sensation or fear words, which were all significantly longer than the neutral words. McNally *et al.*, (1992), replicated their earlier finding of PD subjects exhibiting greater interference for catastrophe words than for fear or positive words. This suggests that the catastrophe words did not produce significantly greater interference than the bodily sensation words. McNally *et al.*, (1992) had expected that the tendency to interpret bodily sensations catastrophically, rather than the experience of the bodily sensations associated with fear, might

differentiate PD from other anxiety disorders. However, they found that OCD subjects produced similar Stroop effects to those with PD (McNally *et al.*, 1992).

The emotionality hypothesis was not supported in the current study. Although positive emotional words were rated as having more emotional valence than neutral, agoraphobic or somatic words they did not bring about longer colour-naming latencies. In fact the positive emotional words produced the fastest colour-naming latencies in both the post therapy and community groups. This supports Richards and Millwood's (1990) claim that pleasant words provide the most contrast to threat words. The results suggest that positive emotional words are easily processed by PD sufferers and are not associated as being a potential threat leading to panic sensations.

In contrast, Martin *et al.*, (1991) produced results with GAD sufferers that supported the emotionality hypothesis. Patients were slower than controls at colour naming both threat words and positive words. Martin *et al.*, (1991) suggested that all emotionally valenced words produced longer colour naming latencies than neutral words in GAD sufferers. McNally *et al.*, (1992) found that PD patients exhibited more interference for positive words compared to non-lexical stimuli, with the interference for positive stimuli being equivalent to that of the threat word categories. They suggest that emotionality can not fully account for these results. McNally *et al.*,'s (1992) study does not necessarily show a processing bias for emotionally stimuli, but for any form of lexical stimuli over non-lexical. This is hardly a surprising finding, as lexical stimuli is likely to be far more meaningful to subjects.

Comparisons between pre- and post therapy

The hypothesis that the clinical group undergoing therapy for panic would show a reduction in idiosyncratic threat word interference, in the direction of the neutral control words, was not supported.

The questionnaire outcome measures including the BAI, BDI, LCB and SCL-90 all showed change in the direction of less symptomatology following therapy. Locus of control, measured by the LCB, became more internal indicating that the subjects felt they had more control over their environment than they did prior to treatment. Partly the self-report questionnaire results might be explained by the expectations of therapy, with individuals wishing to report improvement. However, it does appear that according to these measures, the treatment was successful.

The change with therapy reported by the questionnaire measures was not reflected in performance on the Stroop task. There was no significant difference in the Stroop task from pre- to post-therapy. However, as there was no pattern of specific threat category processing at pre-therapy then there was no clear pattern of symptomatology to expect to decrease with therapy.

It is perhaps not surprising, perhaps, that many years of cognitive processing patterns were not changed over two to three weeks of therapy. The post-test was carried out immediately the treatment group was finished due to the researcher's time restraints. Ideally the post-test should have been at least a month after treatment had finished. Mogg *et al.*, (1992) also found that their recovered GAD subjects could not be significantly differentiated from either the control or clinically anxious groups by an attention task. It is possible that the attentional bias is stable in an individual and does not change with therapy, but that recovered individuals learn to change their behaviour to cope with the biases in a more adaptive manner. If this is so it raises important questions about the likelihood of relapse. However, Watts *et al.*, (1986) did demonstrate change in the colour naming latencies of spider words, in spider phobia sufferers, following therapy.

Clinical and community group comparisons

The hypothesis was that clinical and community panicers would show similar cognitive processing styles, with perhaps difference in detail. In fact there was no differences, between clinical and community groups, detected by the Stroop test. The panicers in the community group had similar levels of symptomatology by the BDI and BAI as the pre-therapy clinical group. The vocabulary difference between the community and clinical groups may be explainable by the Continuing Education course (community group) attracting a more educated group of panicers than the public anxiety clinic. Also the community group completed the vocabulary task in their own time while the clinical group completed it in conjunction with the Stroop task. While the community group were similar in age and age of onset of panic to the clinical group they had more years of formal education and reported less interference from the panic attacks. This might indicate that more educated people are more able to self-treat and resist the agoraphobia that can accompany panic. Many of the community group had already sought some help for their panic, so may already have had strategies and knowledge to make the disorder less frightening. However, as these findings are only correlational, other factors not investigated may account for the differences between the groups.

It was also hypothesised that clinical group will have greater co-occurring disorders and medications and so respond slower overall than a community group The overall speed of response did not differ between clinical and community groups, which, on the surface, is an unexpected finding. One would expect a clinical group to have more psychopathology leading to slower RT's (Mogg *et al.*, 1992: McNally *et al.*, 1990). McNally *et al.*, (1990) found that patients were slower over all stimuli than clinicians. They reported that those with PD had an overall mean RT of 0.848 seconds, while normal controls had an overall mean RT of 0.653 seconds. The overall mean reaction times in the current study were, Pre-therapy clinical group 0.703

seconds, Post-therapy clinical group 0.709 seconds and community group 0.752 seconds. This suggests that the subjects in the current study had overall means between these two extremes in McNally *et al.*,'s. (1990) study. Had the analyses been based on means of means, not means of medians for each subject then the mean RT's would approach slightly higher levels.

As the questionnaires demonstrated, the community group were similar in symptomatology to the pre-therapy clinical group. The community group were largely suffering the full-blown panic disorder, not infrequent panic attacks as might have been expected. Co-existing disorders are one factor likely to cause slower reaction times. The community group were suffering equal degrees of depression by the BDI as the pre-therapy clinical group and depression levels were high in both cases.

Several of the community group subjects had had therapy for panic (unsuccessful) and five were later referred onto PMH for treatment. It is interesting to note this breakdown as it supports the theory that those attending courses on panic do tend to have experienced panic, but tending more towards the full-blown disorder, not infrequent panicers as might have been expected. This may be because only 17 from approximately 50 on the course were tested and asking for volunteers may have attracted the more severe cases.

The community group in the current study served only as a control for the patient/ non-patient variable, as it contained subjects very similar to the experimental group in every other sense. The non-PD controls in the community group produced undifferentiated Stroop effects from the PD sufferers, suggesting that the effect for the processing bias of somatic threat material was not specific to PD sufferers. Ehlers *et al.*, (1988) also found that there was no difference between panic subjects and non-anxious controls on the Stroop task. All showed a bias for threat words. McNally *et al.*, (1992) attempted to test whether fear, bodily sensation and catastrophic words were

specific to PD or extended to other anxiety disorders. Subjects suffering OCD resembled PD subjects in their responses to presumably specific PD threat stimuli. Unlike most anxiety disorders the feared object in PD is not an external stimuli which then triggers internal reactions, (like a spider, in spider phobics). In PD the feared stimuli is thought to be fear's internal sensations. Accordingly, the fear words used for investigations with PD may not be irrelevant for other anxiety disorders (McNally *et al.*, 1992), or even those without anxiety diagnoses.

Interpretation of results

Tentatively, from the results obtained, it seems plausible to hypothesise a general or global priming effect on the target words. The threat words had been highlighted over the period of the study for both the clinical group, who received educational, behavioural and cognitive therapy for two weeks prior to being post-tested on the Stroop task, and the community group who received educational information on panic. This seems at first glance not to fit the idea the literature that familiarity with the Stroop content has little effect on RT's for control subjects such as clinicians (McNally *et al.*, 1990). However, it may be that priming has a role to play in activating the Stroop effect in susceptible individuals.

The clinical group shared a large variety of co-existing disorders, and may have been more anxious generally leading to an elevated baseline RT and less of a range of reaction time results. This is suggested by high state anxiety scores. However, correlations of the state anxiety form of the STAI to word category RT's show no pattern of responding, suggesting that the current state of anxiety has little effect on the processing of these different word categories. The qualitative questions on the Stroop do suggest that a whole threat schema is activated, rather than individual words, as fabrications tended to be along threat lines. Using five sets of threat words and two neutral or positive sets

may have overwhelmed more anxious participants with negative words and raised their anxiety about the task, making it more difficult, with a generally high latency rate for all words. After therapy the range of mean word category responding had doubled, allowing an effect to be seen where positive emotional words were processed faster and somatic words slower.

Priming of words in Stroop tasks by similar words, or positive or negative words has not been fully explored in the literature. In the past studies have tended to use the card system with related words in one block so the time to colour-name each block could be measured. By isolating out each word and randomising their order of appearance the test changes to test whether each single word is capable of activating the schema rather than a fully primed word set. If the Stroop effect is caused by priming, then randomising the words would cause the effect to be lost.

Segal and Vella (1990) found that individuals with depression took longer to colour- name self-descriptive adjectives when they were preceded by another self-descriptive adjective than when the adjective was neutral or personally non-relevant. There is therefore the possibility that each word may not be treated as an isolated event cognitively and a threat word may increase the RT for colour naming not only the target word but several that follow it as well. For this reason it may be essential to provide a distracter stimulus, such as a random coloured pattern, for a few seconds between word trials.

Mogg *et al.*, (1992) point out that the attentional bias in anxiety disorders appears to be a stable, but relatively minor phenomenon, with only 22 milliseconds or 0.022 of a second differentiating responses to threat and non-threat stimuli. The results of the current study found differences between the neutral and threat word categories of 0.012 to 0.052 of a second. This suggests that the results were around the same magnitude as found in Mogg *et al.*, (1992). Because the effect is so minor, Mogg *et al.*, (1992) suggest that extra care must be taken to control spurious factors that may influence results.

Correlations of Stroop task RT's to questionnaire measures

Of concern, few strong correlations of Stroop results with diagnostic categories or questionnaire scores exist. In the current study the state anxiety form of the STAI (Speilberger *et al.*, 1983) did not correlate with Stroop test scores, suggesting that current anxiety is not an important factor in producing the results. Trait anxiety, which the Stroop task is assumed to tap in to, should have also been studied alongside state anxiety. Neither the BAI or BDI scores produced significant correlations with Stroop test RT's. Similarly, Ehlers *et al.*, (1988) found no significant correlations with the state or trait forms of the STAI (Speilberger *et al.*, 1983) the BDI (Beck et al., 1961) and the Mobility Inventory (Chambless *et al.*, 1985). Mogg *et al.*, (1992) also found that their modified Stroop results showed no significant correlations with anxiety and depression self-report measures. McNally *et al.*, (1990) and (1992) did not use any self-report questionnaires and so the validity of the Stroop task in those studies was not addressed.

If the Stroop test measures cognitive processing then changes in cognitive products (ie. self report questionnaires) should also be reflected by changes in the next level of cognition, cognitive processing. While changes would not be expected to be identical, as many transient influences may impact on cognitive products, none-the-less, they would be expected to support similar trends. A relationship between cognitive products and cognitive processing was not found in this study. The Stroop test produced a wide variety of individual variance and could not be related to any other factors to show that reaction times were produced by anything more than random responding.

Further research and limitations of the current study

More basic research to find an optimal standard procedure for using the modified Stroop task with Psychiatric populations would go a long way to making results comparable and aiding interpretation. It would seem sensible to consider this more closely before doing more studies in applied settings. It is impossible to attempt to explain the unknown with the unknown.

An interesting study would be to test whether the length of the inter stimulus break between word presentation does affect the magnitude of the Stroop effect. Exploration is also needed looking at the differences between card and computer methods of administration, especially with regard to the effects of randomisation. Interestingly, in the qualitative questions, subjects rated, that they had a reasonable amount of control over the outcome of the Stroop task. While this is unlikely to be true, it may be worth further investigation. There needs to be more exact replications of studies that have produced significant findings with the Stroop task and PD, before looking further at the question of change in cognitive processing over time.

Several methodological issues need to be considered in future studies looking at the Stroop effect in PD sufferers;

Choice of words

Much planning needs to go into generating word lists and highly differentiated categories. Overlap in the current study between general threat, catastrophic and somatic categories meant that little was likely to be learnt about the subtle differences in meaning implied by each of the different categories.

Fewer word categories

The results suggest that the Stroop is only sensitive to broad threat/non-threat stimuli and so is not likely to be of use in differentiating between different anxiety diagnoses, therefore only a few categories of words should be tested. It seems prudent to continue to use somatic, positive emotional,

neutral and catastrophic word categories with PD populations, as these are the most likely to be differentiated from each other.

Inter stimulus break if using microcomputer

At least a three second inter-stimulus break or distracter item is necessary between words. This will go some way towards ensuring that randomisation has the desired effect of having each word responded to individually, rather than being primed by others in a set of cards, or by the word that precedes it.

Diagnostic categories

In retrospect, PTSD should be included in the diagnostic interview, as patient's suffering from PTSD are likely to report panic symptoms but have different fears from spontaneous panicers. It also would be useful to have phobia sufferers differentiated into social, simple and agoraphobia sufferers, which does not currently occur in DIS-III-R summary sheets.

Identical vs equivalent forms

As few words are recalled from an individuals first trial of the Stroop task, identical forms of the Stroop could be used in retesting subjects on the Stroop task.

Trial number

Obtaining a greater number of trials for each word from each subject may have made the results stronger and less likely to be effected by spurious factors, although this raises the problem of a practice effect and habituation to the sematic content as demonstrated by McNally et al. (1990). In retrospect, some compromise between McNally *et al.*,'s 20 trials of each word and the author's single trial of each word, with around five trials of each word, would have been optimal.

Sample size

The sample size in the current study was exploratory. Larger numbers may show more definite trends. If more subjects could be tested then

regression could be used to explore which personal attributes, as measured by various questionnaires, predict Stroop effects in PD sufferers. As well as investigating pre- and post- therapy, follow up of three and six months after therapy should be investigated, to see if change continues and or maintains, or if relapse can be predicted from Stroop task results.

Colours

Allowing individual subjects to choose what to call each colour at the beginning of the task may give equality in spite of varying experiences of colour may individuals. In was noticeable in the current study that some subjects would have preferred to call orange, "red". Colour clarity, grid size and distance from the screen may also be spurious factors that impact on the result, although information is lacking on the optimal procedure to control for these factors.

Experimental / Control groups

A purer experimental group, without concurrent diagnoses may shed more light on cognitive processing in PD. Control groups ideally should include another anxiety disorder as well as non-anxious controls, to test the specificity of the effects. Finding a truly comparative non-anxious control group for PD patients, is likely to continue to cause problems for researchers.

Conclusions

The modified Stroop test, and what it measures, is still not well understood. Findings using the modified Stroop task and PD have been contradictory in terms of the emotionality hypothesis and predominant concern in PD (somatic versus catastrophic). The stimulus words hoped to be specific to PD, (somatic and catastrophic words), have not been shown to reliably differentiate PD from other anxiety disorders, non-clinical PD populations or non-anxious controls. Stroop task colour-naming latencies have not been reliably found to be related to any particular questionnaire

measure. It is therefore unlikely that the modified Stroop test, in its current form, will be able to offer much to the diagnosis, or evaluation of treatment, of panic disorder sufferers. In short, the validity of what the modified Stroop is measuring, is in question.

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TABLE 3.1. STIMULUS WORDS USED IN THE STROOP TASK

Set A.	Set B.
General threat	
SUFFERING	EMERGENCY
BROKEN BONES	AMBULANCE
MUTILATED	FRACTURES
INJURED	ACCIDENT
DISEASED	DISABLED
VIOLENT	WOUNDED
HAZARD	ASSAULT
PANICKY	CANCER
TRAGIC	DEATH
BLOOD	AGONY
Positive emotional	
AFFECTIONATE	CONFIDENT
CONTENTED	REASSURED
APPRECIATED	OPTIMISTIC
CAREFREE	FRIENDLY
PEACEFUL	EXCITED
GENEROUS	ELATION
HELPFUL	PLEASURE
LOVING	RELAXED
ENJOY	CARING
KIND	HAPPY
Social threat	
CRITICISED	INDECISIVE
INADEQUATE	HUMILIATED
EMBARRASSED	WORTHLESS
FAILURE	INFERIOR
LONELY	IGNORED
PATHETIC	MOCKED
FOOLISH	ASHAMED
STUPID	DISLIKED
INEPT	LOSER
HATED	IDIOT
Neutral	
FUNCTIONAL	MAINTAINED
OCCASIONAL	MOMENTARY
PRONOUNCED	CATEGORY
ADHESIVE	CONTINUE

Set A	Set B.
Neutral cont..	
FOLDED	STANDARD
ORDINARY	PRESERVE
FORTIFY	DESCRIBE
ROUNDED	SMOOTH
ROCKY	WOVEN
BRIEF	SPAN
Somatic	
PALPITATIONS	HEART RACING
CHEST PAIN	DISORIENTATED
HEART BEAT	BREATHLESS
NUMBNESS	PERSPIRE
TINGLING	DRY MOUTH
TREMBLE	SHAKING
UNREAL	HOT FLUSH
CHILLS	NAUSEA
DIZZY	FAINT
SWEAT	BLUR
Catastrophe	
HEART ATTACK	BRAIN TUMOUR
LOSE CONTROL	POWERLESS
PARALYSED	SMOTHERING
COLLAPSE	THROW UP
UNKNOWN	CORONARY
MADNESS	STROKE
SEIZURE	PASS OUT
SCREAM	CHOKING
DYING	CRAZY
DOOM	FATAL
Agoraphobe	
SUPERMARKET	AEROPLANES
RESTAURANT	OPEN SPACES
DEEP WATER	SHOPPING MALL
THEATRE	PARTIES
STREETS	NO ESCAPE
TRAINS	THUNDER
TRAPPED	DARKNESS
TUNNEL	BRIDGE
ALONE	BOAT
CROWD	LIFT

APPENDIX II

[The following program was written in BlankenshipBasic (Copyright John Blankenship) . Hardware required is an Apple IIe (or compatible computer) with a Timemaster II H.O. (Copyright Applied Engineering) board in Slot 4 and a colour monitor). In order to run, the program "Bin.millisec" (supplied with the Timemaster II H.O. board) must be available on the same disc.]

```
**************************************************

1000  COMPILE
1010  HGR
1020  HOME
1030  SPEED= 225
1040  PRINT : PRINT
1045  INPUT "ENTER ID CODE.    ";F$
1046  HOME
1048  PRINT : PRINT
1050  PRINT "THESE ARE THE POSSIBLE COLOURS"
1070  PRINT : PRINT
1080  REM DEMONSTRATION OF COLOURS
1090  PRINT "THIS COLOUR IS GREEN"
1100  HCOLOR= 1
1110  BOXFILL 170,40,180,50
1120  PRINT : PRINT
1130  PRINT "THIS COLOUR IS WHITE"
1140  HCOLOR= 3
1150  BOXFILL 170,60,180,70
1160  PRINT : PRINT
1170  PRINT "THIS COLOUR IS ORANGE"
1180  HCOLOR= 5
1190  BOXFILL 170,85,180,95
1200  PRINT : PRINT
1210  PRINT "THIS COLOUR IS BLUE"
1220  HCOLOR= 6
1230  BOXFILL 170,110,180,120
1240  PRINT : PRINT
1250  RANDOMIZE
1260  PRINT "PRESS ANY KEY TO CONTINUE";H$
1270  GET H$
1280  HOME
1290  IF  PEEK (760) = 76 THEN  CALL 777
1300  IF  PEEK (760) = 76 THEN  GOTO 1290
1310  D$=  CHR$ (4): PRINT D$"BLOAD BIN.MILLISEC"
1320  CALL 768: REM SET UP INTERCEPTS
1330  IF  PEEK (784) = 0 THEN  PRINT "TIMEMASTER NOT FOUND"
1340  DIM SEC(71),MIL(71),HUE(71)
1345  DIM RES$(71),T$(71)
1350  N= 70
1360  PERFORM "GL.INIT"
1370  PERFORM "WORD"
1380  DIM E$(8)
1390  PERFORM "PRACTICE"
1400  PERFORM "MIXARRAY"
1410  PERFORM "MAINPART"
1420  PERFORM "RESULTS"
1430  END
```

```
1440  DEFINE "PRACTICE"
1450    VTAB 9
1460    PRINT "THE NEXT 8 WORDS ARE A "
1470    PRINT "PRACTICE RUN"
1480    PRINT "REMEMBER TO SAY THE COLOUR"
1490    PRINT "THAT THE WORD IS PRINTED IN"
1500    PRINT "AS FAST AND AS ACCURATELY"
1510    PRINT "AS POSSIBLE WITHOUT PAYING"
1520    PRINT "ATTENTION TO THE CONTENT "
1530    PRINT "OF THE WORD"
1540    PRINT "HIT ANY KEY TO BEGIN";P$
1550    GET P$
1560    E$(0)= "CAT"
1570    E$(1)= "CAKE"
1580    E$(2)= "PARK"
1590    E$(3)= "DESK"
1600    E$(4)= "BOOK"
1610    E$(5)= "GARDEN"
1620    E$(6)= "TELEPHONE"
1625    E$(7)= "KITCHEN SINK"
1630    Q= 2
1640    FOR I = 0 TO 7
1650      HOME
1660      TEXT
1670      Z=  INT (4 *  RND (1))
1680      IF Z = 0 THEN COL = 1
1690      IF Z = 1 THEN COL = 3
1700      IF Z = 2 THEN COL = 5
1710      IF Z = 3 THEN COL = 6
1715      IF Q = COL THEN  GOTO 1670
1716      Q= COL
1720      VTAB 9
1730      SIZE$= "2"
1740      MESSAGE$= E$(I)
1750      PERFORM "PRINT.MESSAGE"
1755      FOR T = 1 TO 300
1756      NEXT T
1760      HGR
1770      REPEAT
1780        V=  PEEK (49249)
1790      UNTIL V > 127
1800      HOME
1810    NEXT I
1820    VTAB 9
1830    PRINT "WOULD YOU LIKE TO DO THE"
1840    PRINT "PRACTICE RUN AGAIN? Y/N"
1850    GET M$
1860    HOME
1870    WHEN M$ = "Y" THEN
1880      PERFORM "PRACTICE"
1890    ELSE
1900      VTAB 9
1910      PRINT "HIT ANY KEY TO BEGIN REAL TASK";Q$
1915      PRINT "THERE WILL BE A SHORT WAIT"
1920      GET Q$
1930    ENDWHEN
1940  FINISH
```

```
1950  DEFINE "MAINPART"
1960    REM SETS THE SIZE POSITION AND
1970    REM RANDOM COLOUR FOR EACH WORD
1980    REM DRAWS EACH WORD ON THE
1990    REM TEXT SCREEN
2000    REM SHOWS THE COMPLETED WORD
2010    REM ON THE GRAPHICS SCREEN
2020    HOME
2025    W= 2
2030    FOR I = 1 TO N
2040      TEXT
2050      Z=  INT (4 *  RND (1)) + 1
2060      IF Z = 1 THEN COL = 1
2070      IF Z = 2 THEN COL = 3
2080      IF Z = 3 THEN COL = 5
2090      IF Z = 4 THEN COL = 6
2095      IF W = COL THEN  GOTO 2050
2096      W= COL:HUE(C(I)) = COL
2100      VTAB 9
2110      SIZE$= "2"
2120      MESSAGE$= A$(C(I))
2130      PERFORM "PRINT.MESSAGE"
2135      IF  LEN (MESSAGE$) < 13 THEN
2136      FOR T = 1 TO ((13 -  LEN (MESSAGE$)) * 50)
2137      NEXT T
2140      B= 256
2150      CALL 771
2160      HGR
2170      REM CHECKS IF THE RELAY HAS
2180      REM BEEN VOICE ACTIVATED
2190      REPEAT
2200        V=  PEEK (49249)
2210      UNTIL V > 127
2220      CALL 774
2230      MS= 0: FOR A = 780 TO 783:MS = MS * B +  PEEK (A):
NEXT
2240      Q= MS / 1024:S =  INT (Q):MS = (Q - S) * 1000
2250      SEC(C(I))= S:MIL(C(I)) = MS
2260      HOME
2270    NEXT I
2280  FINISH
2290  DEFINE "MIXARRAY"
2300    REM PERFORMS A BUBBLESORT ON
2310    REM THE MAIN ARRAY
2320    REM EACH WORD APPEARS ONCE ONLY
2330    FOR I = 1 TO N
2340      B(I)= I
2350    NEXT I
2360    FOR I = 1 TO N
2370      X=  INT (N *  RND (1)) + 1
2380      IF B(X) = 0 THEN  GOTO 2370
2390      C(I)= B(X)
2400      B(X)= 0
2410    NEXT I
2420  FINISH
```

```
2430  DEFINE "WORD"
2440    REM MAIN ARRAY
2450    DIM A$(71),B(71),C(71)
2460    A$(1)= "SUFFERING"
2470    A$(2)= "BROKEN BONES"
2480    A$(3)= "MULTILATED"
2490    A$(4)= "INJURED"
2500    A$(5)= "DISEASED"
2510    A$(6)= "HAZARD"
2520    A$(7)= "VIOLENT"
2530    A$(8)= "PANIKY"
2540    A$(9)= "BLOOD"
2550    A$(10)= "TRAGIC"
2560    A$(11)= "AFFECTIONATE"
2570    A$(12)= "CONTENTED"
2580    A$(13)= "APPRECIATED"
2590    A$(14)= "CAREFREE"
2600    A$(15)= "PEACEFUL"
2610    A$(16)= "GENEROUS"
2620    A$(17)= "HELPFUL"
2630    A$(18)= "LOVING"
2640    A$(19)= "ENJOY"
2650    A$(20)= "KIND"
2660    A$(21)= "DIZZY"
2670    A$(22)= "SWEAT"
2680    A$(23)= "TREMBLE"
2690    A$(24)= "TINGLING"
2700    A$(25)= "UNREAL"
2710    A$(26)= "HEART BEAT"
2720    A$(27)= "CHEST-PAIN"
2730    A$(28)= "NUMBNESS"
2740    A$(29)= "CHILLS"
2750    A$(30)= "PALPITATIONS"
2760    A$(31)= "FUNCTIONAL"
2770    A$(32)= "OCCASSIONAL"
2780    A$(33)= "PRONOUNCED"
2790    A$(34)= "ADHESIVE"
2800    A$(35)= "FOLDED"
2810    A$(36)= "ORDINARY"
2820    A$(37)= "FORTIFY"
2830    A$(38)= "ROUNDED"
2840    A$(39)= "ROCKY"
2850    A$(40)= "BRIEF"
2860    A$(41)= "EMBARRASSED"
2870    A$(42)= "CRITICISED"
2880    A$(43)= "PATHETIC"
2890    A$(44)= "STUPID"
2900    A$(45)= "INADEQUATE"
2910    A$(46)= "INEPT"
2920    A$(47)= "HATED"
2930    A$(48)= "FOOLISH"
2940    A$(49)= "LONELY"
2950    A$(50)= "FAILURE"
2960    A$(51)= "HEART ATTACK"
2970    A$(52)= "LOSE CONTROL"
2980    A$(53)= "PARALYSED"
2990    A$(54)= "COLLAPSE"
3000    A$(55)= "UNKNOWN"
3010    A$(56)= "SEIZURE"
3020    A$(57)= "MADNESS"
3030    A$(58)= "SCREAM"
3040    A$(59)= "DYING"
```

```
3050     A$(60)= "DOOM"
3060     A$(61)= "THEATRE"
3070     A$(62)= "SUPERMARKET"
3080     A$(63)= "RESTAURANT"
3090     A$(64)= "CROWD"
3100     A$(65)= "ALONE"
3110     A$(66)= "STREETS"
3120     A$(67)= "TRAINS"
3130     A$(68)= "TRAPPED"
3140     A$(69)= "TUNNEL"
3150     A$(70)= "DEEP-WATER"
3260   FINISH
3270   REM SET COL TO HCOLOR
3280   REM SET SIZE$ TO SIZE OF LETTERS
3290   REM SET MESSAGE$ TO MESSAGE
3300   REM VTAB TO POSITION ON SCREEN
3310   REM MESSAGE WILL BE CENTERED AUTOMATICALLY
3320   REM OUTER DEFINE AND FINISH ALLOWS FILE OF BOTH
MODULES TOGETHER
3330   DEFINE "GL.INIT"
3340     RESTORE.HERE
3350     DIM LE$(25)
3360     FOR M = 0 TO 25
3370       READ LE$(M)
3380     NEXT
3390     DATA UUUUIIJJDDDDUULLLLDD: REM  A
3400     DATA UUUUUURRRJDKLLRRJDKLLL: REM  B
3410     DATA FUNUUUUIRRJFDDDDNKIKLLMFD: REM D
3420     DATA UUUUUURRRJDDDDKLLL: REM D
3430     DATA UUURRRLLLUUURRRRFDDDDDDNLRLLLL: REM  E
3440     DATA UDUUURRRLLLUUURRRRFDDDDDDLLLL: REM   F
3450     DATA FUNUUUUIRRJFDDNLLRRDDKLLMFD: REM   G
3460     DATA UDUUUUUUFRRRRNDUDDDLLLRRRDDDFLLLL: REM   H
3470     DATA FRNRLRRLUUUUUURLLFLDDDDDD: REM  I
3480     DATA FUNJMJRRIUUUUUFLLLLDDDDDD: REM J
3490     DATA UDUUUUUUFRRRRNKIKKKJJJFLLLL: REM K
3500     DATA RRRRLLLLUUUUUUDDDDDD: REM L
3510     DATA UDUUUUUUJJIIDDDDDDFLLLL: REM M
3520     DATA UDUUUUUUJJJJUUUUDDDDDDFLLLL: REM N
3530     DATA FUNUDUUUUIRRJDDDDKLLMFD: REM   O
3540     DATA UDUUUUUURRRJDKLLLDDD: REM   P
3550    DATA FUNJMUUUUIRRJDDDKMJJMKLFL: REM Q
3560    DATA UDUUUUUURRRJDKLLJJJFLLLL: REM   R
3570    DATA FUNJMJRRIUMLLMUIRRJFLLLLDDDDD: REM S
3580    DATA FRRNUDUUUUUURRLLLLFDDDDDD: REM T
3590    DATA FRNMJRRIUUUUUFLLLLNDUDDDDDFD: REM U
3600    DATA FUUNUUUUDDDDJJIIUUUUFLLLLDDDDDD: REM  V
3610    DATA IIJJUUUUUUFLLLLNDUDDDDDD: REM  W
3620    DATA UDUIIIIUFLLLLNDUDJJJJDFLLLL: REM  X
3630    DATA FRRNUDUUUIIUFLLLLNDUDJJFLLDDD: REM  Y
3640    DATA RRRRLLLLUIIIIULLLLFDDDDDD: REM   Z
3650  FINISH
3660  DEFINE "PRINT.MESSAGE"
3670    REM CONVERTS TEXT TO WORD GRAPHICS
3680    M=  PEEK (37)
3690    HCOLOR= 0
3700    HPLOT (280 -  LEN (ME$) * 7 * VAL (SIZE$)) / 2,M *8
3710    HCOLOR= COL
3720    FOR M = 1 TO  LEN (MESSAGE$)
3730      ME=  ASC ( MID$ (MESSAGE$,M,1))
3740      WHEN ME >  = 65 AND ME <  = 90 THEN
3750        FOR M1 = 1 TO  VAL (SIZE$)
```

```
3760           DRAW.USING SIZE$
3770           DRAW.USING LE$(ME - 65)
3780           DRAW.USING "1FR"
3790         NEXT
3820       ENDWHEN
3830       DRAW.USING SIZE$ + "FRRRRRR"
3840     NEXT
3850   FINISH
3860FINISH
3870DEFINE "RESULTS"
3880   REM PRINTS WORDS AND RTS
3890   REM IN ORIGINAL ORDER
3895   VTAB 9
3896   PRINT "THE END, THANK YOU"
3900   DISK "OPEN ";F$
3910   FOR I = 1 TO N
3915     DISK "WRITE ";F$
3920     PRINT A$(C(I)) + " " +  STR$ (SEC(C(I)))"." LEFT$ (
STR$ (MIL(C(I))) + "00",3)
3925     PRINT  STR$ (HUE(C(I)))
3930   NEXT I
3940   DISK "CLOSE ";F$
3950   TEXT
3960FINISH
```

APPENDIX III: WORD EMOTIONALITY RATING FORM

PLEASE RATE THE EMOTIONAL CONTENT OF THE FOLLOWING WORDS, FROM 1 TO 5, BY CIRCLING THE NUMBER CORRESPONDING TO YOUR ANSWER.

1 (VERY UNPLEASANT), 2 (UNPLEASANT), 3 (NEUTRAL),
4 (PLEASANT), 5 (VERY PLEASANT).

DO NOT DWELL ON EACH WORD.

SUFFERING	1	2	3	4	5	FUNCTIONAL	1	2	3	4	5
BROKEN BONES	1	2	3	4	5	OCCASSIONAL	1	2	3	4	5
MUTILATED	1	2	3	4	5	PRONOUNCED	1	2	3	4	5
INJURED	1	2	3	4	5	ADHESIVE	1	2	3	4	5
DISEASED	1	2	3	4	5	FOLDED	1	2	3	4	5
HAZARD	1	2	3	4	5	ORDINARY	1	2	3	4	5
VIOLENT	1	2	3	4	5	FORTIFY	1	2	3	4	5
PANIKY	1	2	3	4	5	ROUNDED	1	2	3	4	5
BLOOD	1	2	3	4	5	ROCKY	1	2	3	4	5
TRAGIC	1	2	3	4	5	BRIEF	1	2	3	4	5
EMERGENCY	1	2	3	4	5	MAINTAINED	1	2	3	4	5
AMBULANCE	1	2	3	4	5	MOMENTARY	1	2	3	4	5
FRACTURES	1	2	3	4	5	CATEGORY	1	2	3	4	5
ACCIDENT	1	2	3	4	5	CONTINUE	1	2	3	4	5
DISABLED	1	2	3	4	5	STANDARD	1	2	3	4	5
WOUNDED	1	2	3	4	5	PRESERVE	1	2	3	4	5
ASSAULT	1	2	3	4	5	DESCRIBE	1	2	3	4	5
CANCER	1	2	3	4	5	SMOOTH	1	2	3	4	5
DEATH	1	2	3	4	5	WOVEN	1	2	3	4	5
AGONY	1	2	3	4	5	SPAN	1	2	3	4	5
CRITICISED	1	2	3	4	5	AFFECTIONATE	1	2	3	4	5
INADEQUATE	1	2	3	4	5	CONTENTED	1	2	3	4	5
EMBARRASSED	1	2	3	4	5	APPRECIATED	1	2	3	4	5
FAILURE	1	2	3	4	5	CAREFREE	1	2	3	4	5
LONELY	1	2	3	4	5	PEACEFUL	1	2	3	4	5
PATHETIC	1	2	3	4	5	GENEROUS	1	2	3	4	5
FOOLISH	1	2	3	4	5	HELPFUL	1	2	3	4	5
STUPID	1	2	3	4	5	LOVING	1	2	3	4	5
INEPT	1	2	3	4	5	ENJOY	1	2	3	4	5
HATED	1	2	3	4	5	KIND	1	2	3	4	5
INDECISIVE	1	2	3	4	5	CONFIDENT	1	2	3	4	5
HUMILIATED	1	2	3	4	5	REASSURED	1	2	3	4	5
WORTHLESS	1	2	3	4	5	OPTIMISTIC	1	2	3	4	5
INFERIOR	1	2	3	4	5	FRIENDLY	1	2	3	4	5
IGNORED	1	2	3	4	5	EXCITED	1	2	3	4	5

PLEASE RATE THE EMOTIONAL CONTENT OF THE FOLLOWING WORDS BY CIRCLING A NUMBER, FROM 1 (VERY UNPLEASANT) TO 5 (VERY PLEASANT)

MOCKED	1	2	3	4	5	ELATION	1	2	3	4	5
ASHAMED	1	2	3	4	5	PLEASURE	1	2	3	4	5
DISLIKED	1	2	3	4	5	RELAXED	1	2	3	4	5
LOSER	1	2	3	4	5	CARING	1	2	3	4	5
IDIOT	1	2	3	4	5	HAPPY	1	2	3	4	5
HEART ATTACK	1	2	3	4	5	HEART RACING	1	2	3	4	5
LOSE CONTROL	1	2	3	4	5	DISORIENTATED	1	2	3	4	5
PARALYSED	1	2	3	4	5	BREATHLESS	1	2	3	4	5
COLLAPSE	1	2	3	4	5	PERSPIRE	1	2	3	4	5
UNKNOWN	1	2	3	4	5	DRY MOUTH	1	2	3	4	5
SEIZURE	1	2	3	4	5	SHAKING	1	2	3	4	5
MADNESS	1	2	3	4	5	HOT FLUSH	1	2	3	4	5
SCREAM	1	2	3	4	5	NAUSEA	1	2	3	4	5
DYING	1	2	3	4	5	FAINT	1	2	3	4	5
DOOM	1	2	3	4	5	BLUR	1	2	3	4	5
BRAIN TUMOUR	1	2	3	4	5	SUPERMARKET	1	2	3	4	5
POWERLESS	1	2	3	4	5	RESTAURANT	1	2	3	4	5
SMOTHERING	1	2	3	4	5	DEEP WATER	1	2	3	4	5
THROW UP	1	2	3	4	5	THEATRE	1	2	3	4	5
CORONARY	1	2	3	4	5	STREETS	1	2	3	4	5
STROKE	1	2	3	4	5	TRAINS	1	2	3	4	5
PASS OUT	1	2	3	4	5	TRAPPED	1	2	3	4	5
CHOKING	1	2	3	4	5	TUNNEL	1	2	3	4	5
CRAZY	1	2	3	4	5	ALONE	1	2	3	4	5
FATAL	1	2	3	4	5	CROWD	1	2	3	4	5
PALPITATIONS	1	2	3	4	5	AEROPLANES	1	2	3	4	5
CHEST PAIN	1	2	3	4	5	OPEN SPACES	1	2	3	4	5
HEART BEAT	1	2	3	4	5	SHOPPING MALL	1	2	3	4	5
NUMBNESS	1	2	3	4	5	PARTIES	1	2	3	4	5
TINGLING	1	2	3	4	5	NO ESCAPE	1	2	3	4	5
TREMBLE	1	2	3	4	5	THUNDER	1	2	3	4	5
UNREAL	1	2	3	4	5	DARKNESS	1	2	3	4	5
CHILLS	1	2	3	4	5	BRIDGE	1	2	3	4	5
DIZZY	1	2	3	4	5	BOAT	1	2	3	4	5
SWEAT	1	2	3	4	5	LIFT	1	2	3	4	5

APPENDIX IV: EXTRA QUESTIONS FOR THE COMPUTER TASK.

Please circle your answer and write any extra information in the spaces provided.

1) Did you use any strategy to focus on the colour and ignore the word content?

Yes/ No

If 'Yes' please specify.

---

2) How much control did you feel as if you had over the outcome of the computer task?

none at all **0-----1-----2-----3-----4** total control

3) Do you have any idea what the aim of the computer task was?

Yes / No

If 'Yes' please specify.

---

4) Please write down any words that you remember.

APPENDIX V : CONSENT FORMS

UNIVERSITY OF CANTERBURY DEPARTMENT OF PSYCHOLOGY

CONSENT FORM (1)- CLINICAL SUBJECTS

Brief description of the project: This project is about thinking processes in anxiety. After an initial interview you will have an experimental session where you will be asked to complete two simple tasks involving words and to fill in a questionnaire about anxiety. One word task involves a computer. Words will be presented onto the computer screen, written in one of four colours. You will be asked to name the colour each word in printed in, as fast and as accurately as possible, without paying attention to the content of the word. You will complete some questionnaires about anxiety from PMH hospital both before and after completing a treatment group. If you agree to take part in this study then data from these questionnaires will also be used by the researchers.

Risks associated with participation: There are no known risks associated with taking part in this study.

Time required: The initial interview may take up to an hour. The experimental session will take approximately 30 minutes. The questionnaires may take up to an hour combined. If you complete a treatment group, a further session of 15 minutes, comprising only of a repeat computer task, is required.

Name of researcher Karen Knowles
Supervisor Mr Neville Blampied

I agree to participate in the project described above, on the understanding that if at any time I wish to withdraw from the experiment, I may, without prejudice, do so. All information collected will be confidential to the researchers, as will my identity, and may only be passed on to the clinician in charge of me. Clinical backup from the Anxiety Disorders Team is available for all participants.

Name of subject _____

Signature _____ **Date** _____